SCIENTIFIC AMERICAN

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THE NAVAL PARADE AND REVIEW.

The combined fleet of American and foreign war vessels which had been gathering at Hampton Roads for some two weeks previous, to participate in the inauguration of our Columbian festivities, sailed from that port on April 24 for New York, under command of Admiral Gherardi. The interchange of courtesies among the officers of so many different nations was most cordial, and interesting in the highest degree, the time which the vessels were at Fort Monroe being occupied by an almost uninterrupted round of entertainments, including boat races among the different crews and sea maneuvering by the vessels. The ships went to sea in double column, the American, German, and Dutch forming the port column, and the British, Russian, French, Italian, and Brazilian the starboard column, and in pretty nearly this order they reached the Lower Bay of New York on the following day. The three Spanish vessels, the Infanta Isabel, Reina Regenta, and Nueva Espana, having in tow the three Columbus caravels, did not remain at Hampton Roads, to come from there with the fleet; but fearing that the weather might not be favorable for the towing of the caravels, they made the voyage a day earlier, safely anchoring their small craft at the assigned places in the North River.

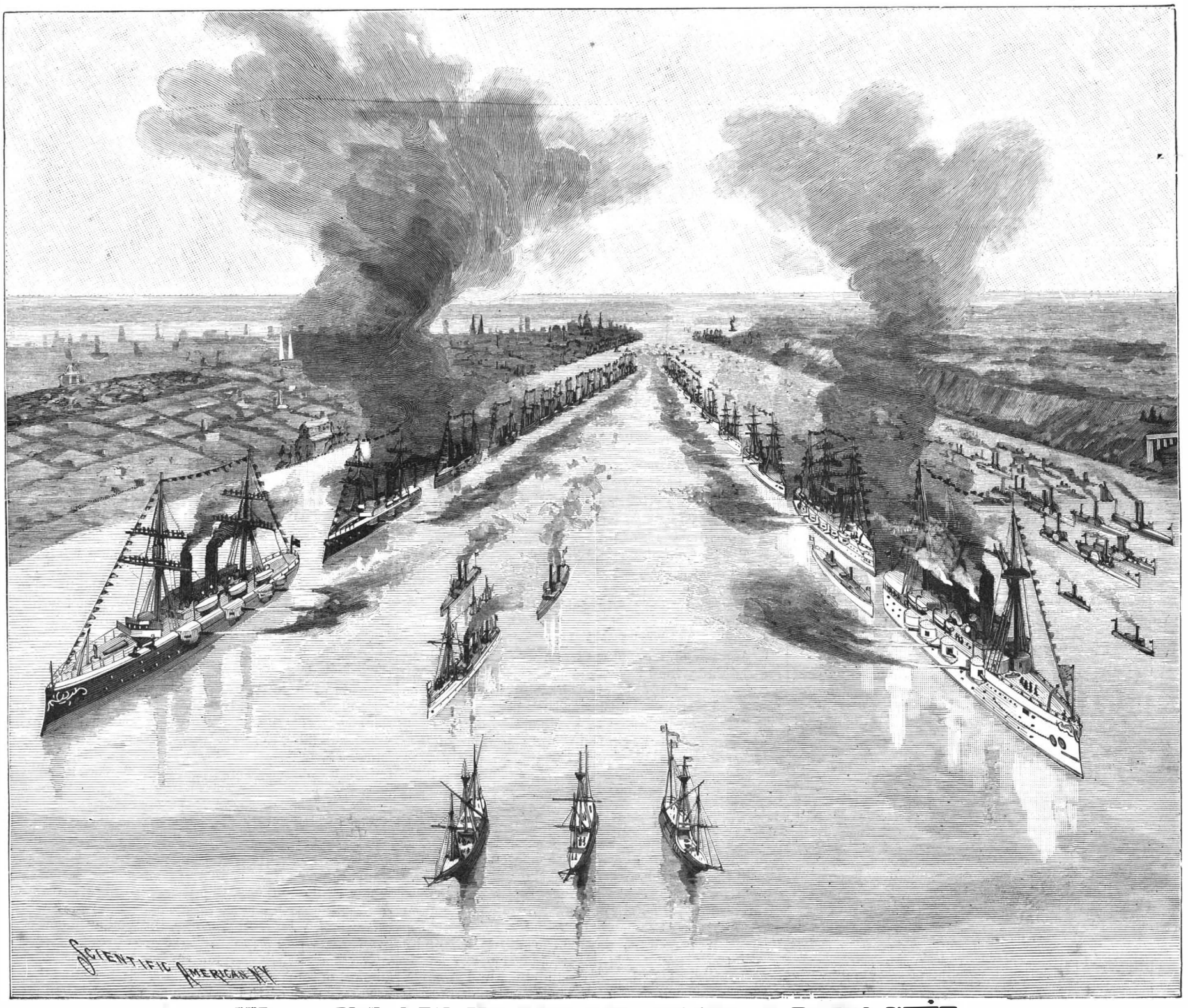
At 9 o'clock in the morning of April 26, the signal to "Prepare to get under way" was flung out from the Philadelphia, Admiral Gherardi's flagship, and answering pennants responded from all the warships, where everything had been put in most complete readiness for making a grand entrance to the harbor and port of New York. The day was bright and beautiful, and a stately panorama was then presented to the many thousands who covered the high grounds of Staten Island and the Long Island shore from the Narrows up, and crowded the tops of buildings and the lines of the wharves of three cities as the combined fleet came forward up the magnificent bay and the noble river at slow speed, and the vessels maintaining measured distances, until the anchorage ground was reached, opposite the beautiful Riverside Park.

Forts Hamilton and Wadsworth saluted the vessels as they passed up, but on this occasion the salutes were only answered by the flags of the fleet. There was constant signaling between the vessels to maintain the proper distances and order, the formation and sailing order calling for 900 feet of water between columns and a similar distance between ships. The order of the parade, and in which the vessels came to anchor for the review on the following day, was as follows:

PORT COLUMN.—*United States.*—Rear Admiral Gherardi, commander-in-chief: 1, Philadelphia (flag). 2, Newark (flag). 3, Atlanta. 4, San Francisco. 5, Bancroft. 6, Bennington. 7, Baltimore. 8, Chicago (flag). 9, Yorktown. 10, Charleston. 11, Vesuvius. 13, Concord. *Argentina.*—Rear Admiral Howard. 13, 9 de Julio. *Holland.*—Capt. Arriens. 14, Van Speyk. *Germany.*—Capt. Buchsel. 15, Kaiserin Augusta. 16, Seeadler. *United States.*—17, Miantonomoh. STARBOARD COLUMN.—*Great Britain.*—Vice Admiral Sir John Hopkins, commander-in-chief. 1, Blake (flag). 2, Australia. 3, Magicienne. 4, Tartar. *Russia.*—Vice Admiral Koznokoff, commander-in-chief. 5, Dimitri Donskoi (flag). 6, General Admiral. 7, Rynda. *France.*—Rear Admiral de Libran, commander-in-chief. 8, Arethuse (flag). 9, Hussard. 10, Jean Bart. *Italy.*—Rear Admiral Magnaghi, commander-in-chief. 11, Etna (flag). 12, Giovanni Bausan. *Spain.*—Rear Admiral Gomez y Lono, commander-in-chief. 13, Infanta Isabel (flag). 14, Reina Regenta. 15, Nueve Espana. *Brazil.*—Rear Admiral de Noronha, commander-in-chief. 16, Aquidaban (flag). 17, Tiradentes. 18, Republica.

During the passage up, the U. S. monitor Miantonomoh did not take her position until the other vessels of the fleet had passed up the river, as she was stationed opposite the Battery to fire a salute from her great ten inch guns on the unveiling of a statue of John Ericsson at that place, the exercises in connec-

(*Continued on page 280.*)



THE COLUMBIAN NAVAL FESTIVITIES, NEW YORK—THE PRESIDENTIAL REVIEW.

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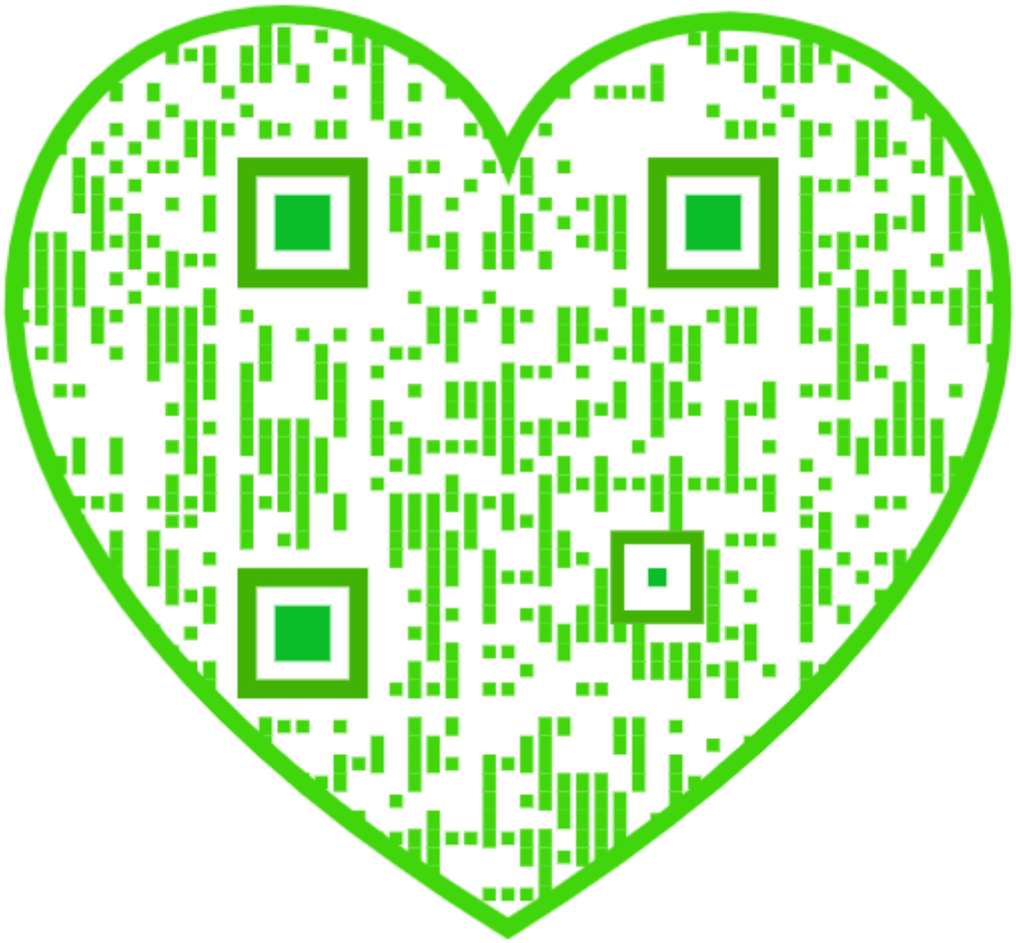

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OPERATIONS OF THE CANADIAN PATENT OFFICE.

We are indebted to the Minister of Agriculture of Canada for a copy of his report for the year 1892, which contains the proceedings of the Canadian Patent Office.

In Canada patents are granted very much on the same system as in this country, but the life of the patent is eighteen years, divided into three periods of six each, according to the amount paid by the applicant. Payments on the great majority of patents are not continued beyond the period of six years. An American patent that is not more than one year old can be patented in Canada, but it is necessary, in order to maintain the validity of the patent, that it shall be worked in Canada within two years.

In 1892 there were granted a total of 3,417 Canadian patents, of which 2,227 were taken by American citizens, 671 by Canadians, 298 by Englishmen, 106 by Germans, 26 by Frenchmen, and 89 by persons of other nationalities. It will thus be seen that nearly two-thirds of all the patents granted in Canada are to American inventors, and but for them the Canadian Patent Office would make a very poor showing. The entire receipts of the Canadian Patent Office were $84,720, and the expenditures were $39,643, leaving a profit of $45,000 over expenses. It may be said that American inventors chiefly support the Canadian Patent Office as well as the Patent Bureau at Washington.

TREATMENT OF POTATOES TO PREVENT POTATO SCAB.

A recent number of the *Rural New Yorker* contains an article by H. L. Bolley, illustrated by photographs, showing the advantage of soaking the seed tubers in corrosive sublimate solution. The author says it has been demonstrated that the blackened, pock-marked condition of potatoes, commonly spoken of as potato scab, is due to the direct action of a parasitic cause which not only originates disease on the tubers, but also affects the roots and bases of the vines. The disease is propagated in the new crop from that on the seed tubers, and the author claims that, if the tubers are treated with the substance mentioned, the plants will be free from the disease.

Photographs are given of potatoes grown without having the seed tubers treated and those that were treated. The treated seed yielded potatoes that were clean and free from disease. The treatment is easy of application and the yield is increased. The seed tubers were soaked for one and one-half hours in a one one-thousandth solution of corrosive sublimate. The author claims that the ordinary method of spraying the vines is simply a waste of energy, as the inception of the disease is from below.

OPENING OF THE WORLD'S COLUMBIAN EXPOSITION, CHICAGO, MAY 1, 1893.

The formal dedication of the Exposition buildings in October last was attended with much pomp and ceremony. It was, therefore, decided that the exercises pertaining to the opening of the great affair should be impressive, yet at the same time very simple. Among the most prominent guests who received invitations for the opening exercises were: The President of the United States, the Duke of Veragua, the lineal descendant of Columbus, the Vice-President, members of the Cabinet, the judges of the Supreme Court, the diplomatic corps, senators, members of the House of Representatives, the governors of the several States, the mayor and city government of Chicago, Chicago park commissioners, the members of the governing boards of the Exposition, and the members of the board of lady managers.

The programme is as follows:

1. Music—Columbian March and Hymn—John K. Paine.
2. Prayer.
3. Presentation of chiefs of departments and foreign commissioners by the Director-General.
4. Music—"In Praise of God"—Beethoven.
5. Address and opening of the World's Columbian Exposition by the President of the United States.
6. Starting of machinery, during which time will be performed "Hallelujah Chorus"—Handel.
7. Official visit from the President of the United States and the officials of the World's Columbian Exposition and the World's Columbian Commission to the various departments, arrangements having been made previously with each chief to receive them.

The formal opening exercises were arranged to take place in the Grand Plaza, on the east front of the Administration building. The invited guests of the occasion were seated on the platform, as well as the members of the grand chorus. It is estimated that 100,000 people may here witness the exercises without being overcrowded. After the opening programme has been carried out and President Cleveland has declared the Exposition opened, and pressed the electric button by which the machinery is put in operation, the guests were to be escorted through the buildings and grounds.

How to Reach the Grounds.—The accompanying official map of Jackson Park shows the arrangement of the Exposition grounds and buildings, and the relation of the Midway Plaisance to it. The steamboats land their passengers at the great pier. The Illinois Central Railroad has built a station at 60th St., where all passengers by this route will be landed. All the other railroads land their passengers in the Great Railway Terminal station inside the grounds. The elevated railroad has built a station over the annex to the Transportation building, which is near the heart of the grounds. Most of the visitors reaching the grounds by the cable roads land at the north end of the grounds, near the 57th St. entrance. The more important entrances to the grounds are 57th St., 59th St., 60th St., 62d St., and 64th St.

The Midway Plaisance, as will be seen from the map, comprises a strip of land between 59th and 60th Sts., extending from Stoney Island Avenue to Cottage Grove Avenue. It is here that all concessions have been granted, with two or three exceptions, that are not necessary features of the Exposition. There are several entrances to the Midway Plaisance, and it is reached from the Exposition grounds by a large entrance opposite the Woman's building. A viaduct has been built by which Stoney Island and the other avenues crossing the Plaisance are elevated, so that visitors can pass back and forth without crossing any highways.

The Entrances.—Entrance tickets to the grounds are on sale at hotels, railway stations and in many other designated places throughout the city and also at an abundance of ticket offices at the entrances to the Exposition grounds. There are nearly two hundred ticket windows at the entrances to the grounds and 325 turnstiles. The several routes by which the grounds are reached from all parts of the city are so far perfected in their arrangements for carrying passengers that there is little doubt that they will be able to accommodate all who may attend.

The Japanese make one of the most complete and comprehensive exhibits of any foreign nation, being represented in all but two or three of the larger buildings, in addition to some special exhibits and concessions. Their displays in the Manufactures and Liberal Arts building include silks, pottery, porcelains, art work and other manufactures, while in the Agricultural building is a fine exhibit of tea and other products, and in the Horticultural building many plants, flowers and examples of Japanese gardening and floriculture. At the north end of the Wooded Island the Japanese government has erected a very attractive structure, which has just been dedicated with considerable ceremony, and which will be formally presented to the Chicago park commissioners at the close of the Exposition as a permanent memorial. The building is a fine specimen of Japanese handiwork and architecture. It is one story high and consists of three pavilions, each representing an important era in architecture and decoration in the history of Japan. The right wing represents an era corresponding to the period of the discoveries of Columbus. Other features of the Japanese exhibit will be the Japanese village, concession for which was granted on Midway Plaisance, and tea houses in the Exposition grounds proper. The Art Gallery, Fisheries building and other buildings also contain interesting exhibits from these people.

Side Shows and Concessions.—So many concessions have been granted by the World's Columbian Exposition that the impression has got abroad that the fifty cents admission fee to the grounds entitles the visitor to see only a part of the Exposition proper. This impression is erroneous, decidedly so. All the buildings, both those erected by the Exposition and those erected by the several States and foreign nations, are open to the public without cost, and all the exhibits in the Exposition are also open to the inspection of the public without additional cost. The fifty cents admission permits the visitor to see the whole Exposition and enjoy many comforts such as seats in the buildings and grounds, retiring rooms, drinking water, and the like. But there are many duplicates of these comforts, besides other extras, for which a small charge is made. Visitors will have an abundant supply, without cost, of all the conveniences necessary to their comfort; but if they are willing to pay for extras, they will secure a little more seclusion and perhaps somewhat more luxurious arrangements. There are always plenty of people who are willing to pay extra for special conveniences, and the Exposition proposes to take advantage of this tendency and benefit by it, so as to increase its legitimate income in every way possible. The estimated cost in round numbers is $22,000,000 to open the Exposition to the public. In addition to this, there will be large running expenses during the six months it is open; so that in order to meet the outlay from entrance admission alone, there would be necessary an attendance of about 50,000,000 people. In order to make the Exposition a model as an exposition and also a success as a business venture, the management has availed itself of every possible source of revenue.

The many concessions must bring in returns to the amount of some millions of dollars. It need not be a necessary part of the programme of each visitor to pay a visit to the promenade on the roof of the Manu-

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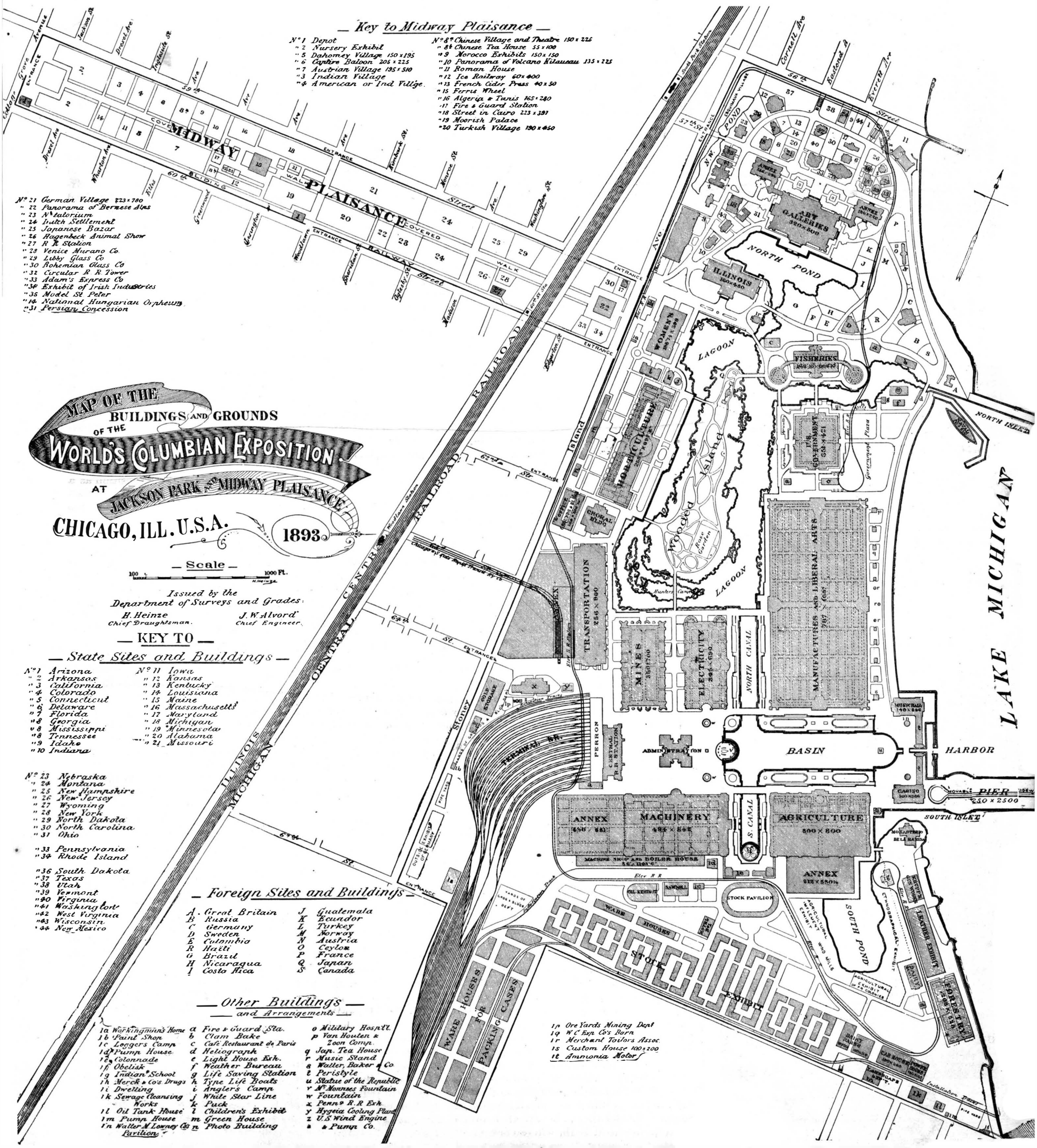
factures and Liberal Arts building; to buy spring water, when sterilized lake water is furnished free; to pay for the use of retiring rooms, when equal conveniences are furnished for nothing, and so on through a long list of similar concessions, so long as none of his legitimate rights are interfered with; but if he can spare the cost, he will indulge in some or all of these extras and not begrudge the few cents they may cost, if his money goes toward making the Exposition a success financially.

The various enterprises on the Midway Plaisance are under the auspices of the Exposition management, but strictly speaking are not a legitimate part of the Exposition, though an interesting and perhaps a necessary adjunct to it. These various enterprises require an admission fee.

Tests of Dairy Cattle.—For some time past there has been an interesting herd of cattle at the Exposition grounds which has attracted considerable attention from its early arrival. This herd consists of forty-nine Jersey and thirty-two Guernsey, but others are coming in rapidly. The tests which will be made of dairy cattle will be very complete, and the matter of making the tests will be in the hands of a committee composed of representatives of the several cattle associations and other experts. The tests begin May 1 and close October 27. The main purpose of the tests is to compare the relative merits of the various breeds of dairy cattle. The best methods of handling milk, cream, and their products, butter and cheese, will be illustrated. Each breed competing in the more important tests will be represented by twenty-five registered cows, except the Brown Swiss and the Red Polled breeds, which will be represented by at least fifteen cows. The milk from each cow will be weighed as soon as drawn, and be tested as to its percentage of butter, fat, and other solids. The milk from all the cows of the same breed will then be mixed and tested in a like manner. The cream is to be separated from the milk by improved mechanical processes and the following scale of points will be used in testing the butter; flavor, 55; grain, 25; solidity, 10; color, 10. The scale for testing cheese will be as follows: flavor, 55; texture, 25; keeping quality, 15; color, 5.

A PHILOSOPHICAL statistician calculates that in the year 2000 there will be 1,700,000,000 people who speak the English language, and that the other languages will be spoken by only 500,000,000 European people.



THE WORLD'S COLUMBIAN EXPOSITION, CHICAGO, 1893—OFFICIAL MAP OF GROUNDS AND BUILDINGS.

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AN ELECTRICAL ROCKING CHAIR.

A dynamo attachment for a rocking chair, designed to send a mild current of electricity through a person sitting in the chair, such current being generated by the motion of rocking, is shown in the accompanying illustration, and has been patented by Mr. Charles E. Hartelius, of Bay Ridge, N. Y. (box 94). The dynamo, which may be of any usual type, is fastened on the under side of the chair seat, and on one side of the field

HARTELIUS' ELECTRICAL ATTACHMENT FOR ROCKING CHAIRS.

of the dynamo is a keeper connected with a handle rod on the chair back, by adjusting which the pole pieces may be connected at any desired point to control the strength of the current. The dynamo is driven by a belt from a shaft journaled in hangers on the chair bottom, the shaft being operated by a belt from one end of a lever in connection with a spring and ratchet mechanism. The lever is pivoted to the lower end of a hanger, and at its rear end is a caster or roller, which runs upon the floor, so that as the chair rocks the lever is alternately depressed and elevated. The dynamo is connected by wires with electrodes on the arms of the chair, or with hand pieces, which may be held by one desirous of receiving the current, or with metal foot rests, so that one may by either means receive a mild current of electricity. A gentle current may thus be taken for any desired length of time, the chair being used in the ordinary way when the body is kept out of contact with the electrodes.

TRICKS IN PRESTIDIGITATION.

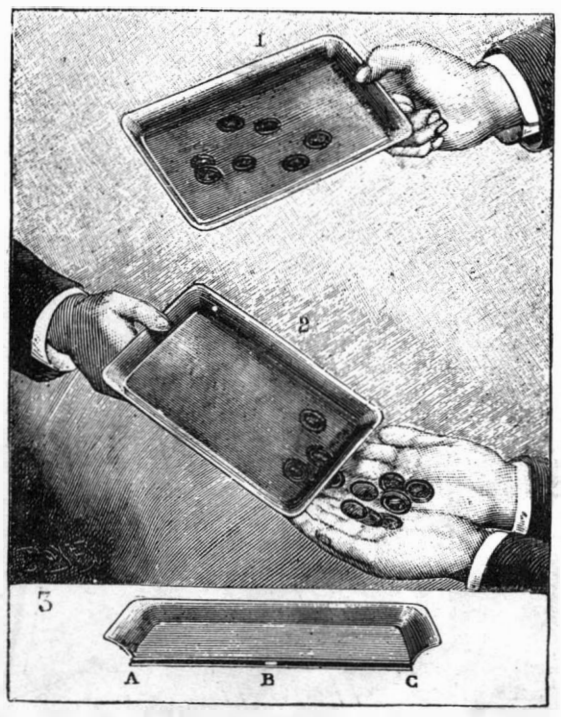
Multiplication of Coins.—In prestidigitation, very simple experiments, that seem childish as soon as the secret of them is known, often produce quite an effect during the performance and cause the spectators more surprise than do many skillful and complicated tricks. Such is the case with the one that we are about to describe.

Upon a small rectangular tray of japanned sheet iron, similar to those in common use, are placed seven coins (Fig. 1). A spectator is asked to receive these in his hand and to put the coins back upon the tray, one by one, and to count them with a loud voice as he does so. It is then found that the number has doubled, there being fourteen instead of seven. The same operation repeated gives as a result twenty-one coins.

As may be seen in the section in Fig. 3, the tray has a double bottom, forming an interspace a little wider than the thickness of one of the coins, and which is divided breadthwise into two equal compartments by a partition, B. These two compartments are closed all around save at the ends of the tray, where there are two apertures, A and C, that in length are double the diameter of the coins. In this interspace are concealed fourteen coins, seven on each side. When the contents of the tray are emptied into the hand of a spectator, the coins concealed in one of the compartments drop at the same time (Fig. 2). The operator then takes the tray in his other hand and thus naturally seizes it at the end at which the now empty compartment exists, and this allows the seven coins that are contained in the other compartment to join the first ones, when the latter are rapidly emptied into the hands of the spectator for the second time.

A square tray, with a double bottom divided into four compartments by divisions running diagonally from one corner to another, would permit of increasing the number of coins four times.

Let us say, however, that skillful prestidigitators dispense with the double bottom. They hold the coins sometimes under the tray with their fingers extended, and sometimes on the tray, under their thumbs, and renew their supply several times from secret pockets skillfully arranged in various parts of their coats, where the spectators are far from suspecting the existence of them.



Figs. 1 2 AND 3.—MULTIPLICATION OF COINS.

The Wine and the Water.—After having done considerable talking, as required by his profession, a prestidigitator is excusable for asking permission of his spectators to refresh himself in their presence, especially if he invites one of them to come to keep him company.

An assistant then brings in upon a tray two claret glasses and two perfectly transparent decanters, one of which contains red wine and the other water. The prestidigitator asks his guest to select one of the two decanters and leave the other for himself. No hesitation is possible. The guest hastens to seize the wine and each immediately fills his glass. How astonishing! Upon its contact with the glass the wine changes into water and the water becomes wine. Judge of the hilarity of the spectators and the amazement of the victim! The pretended wine was nothing but the following composition: 1 gramme permanganate of potash and 2 grammes sulphuric acid dissolved in 1 quart of water. This liquid is instantaneously decolorized on entering the glass, at the bottom of which has been placed a few drops of water saturated with hyposulphite of soda. As for the water in the second decanter, that had had considerable alcohol added to it, and at the bottom of the glass that was to receive it had been placed a small pinch of aniline red, which, as well known, possesses strong tinctorial properties. The glasses must be carried away immediately, since in a few instants the wine changed into water loses its limpidity and assumes a milky appearance.—*La Nature.*

Manufacture of Bronze Powder.

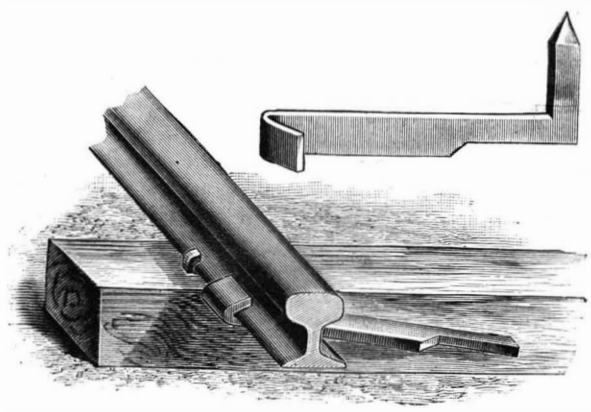
The United States commercial agent at Furth says the greater part of the bronze powder exported from Germany is manufactured in and near the cities of Furth and Nuremburg, about a hundred establishments being engaged, the factories being generally situated on some small stream, where water furnishes cheap power for driving the hammers and stamps. Bronze powder is composed of copper, tin, zinc, and antimony melted in proper proportions, and cast first into rods of half an inch in diameter and about three feet long. These rods are then rolled until about two inches wide, and then cut into suitable lengths for handling. These pieces then go to the hammers, where they are beaten into a very small fraction of their former thickness, and are then taken to a sulphuric acid bath, where each sheet is washed to remove all impurities, rust, and dirt. After being thoroughly dried, the sheets are again hammered by steam hammers until no further reduction is possible, there being a limit to which machinery can be used.

Up to this stage the treatment the metal receives, whether intended for metal leaf or powder, is identical; but now the process changes. If designed for metal leaf, the further beating must be done by hand, but if for bronze powder the sheets go to the shears, where they are cut up into small particles, and now become known as clippings. These are now ready for the stamp mills, which are run in batteries, enabling one man to run or attend fifty or more. When sufficiently pulverized, the powder is sifted in a peculiar manner, the heavier and better qualities going to one receptacle and the inferior grades to another. The cheaper qualities are mixed with quartz powder to enable them to be sold cheaply. The expense of manufacturing bronze powder rests largely in the production of the clippings, a great deal of hand work being required.

Of late years manufacturers in the United States have begun the manufacture of bronze powder, and have purchased the raw material in Bavaria, which appears to have excited fears that ultimately the manufacture will be successfully installed here and the business in Germany broken up. In order to prevent such a disaster to themselves, the manufacturers of bronze powder have entered into an arrangement whereby they all agree not to sell any clippings to be exported to the United States except through a committee, which places the orders at an agreed price, namely, one shilling and threepence per pound, a price which they hope and expect will virtually stop the demand. Bronze powder is sold at prices varying from one shilling per pound for the very cheapest to three shillings for the best quality, the duty being sixpence per pound, irrespective of quality or value. The exports of bronze powder and metal leaf to the United States from the two places, Furth and Nuremburg, in the year 1892, amounted in value to about £140,000, this country taking the greater part of the German exports of bronze powder.

A TIE-DOG FOR RAILROAD RAILS.

The tie-dog whose application is shown in the picture, to prevent the spreading and breaking of rails, has been patented by Mr. John T. Feindel, of Somerville, N. J., and it is intended that where it is used an even gauge of track will be more easily maintained,



FEINDEL'S TIE-DOG FOR RAILROAD RAILS.

and that it will not be necessary to use as many ties to the mile as heretofore. The dog has a claw at one end to engage the outer flange of the rail, and at the other end of the dog is a laterally projecting spike arm to be driven into the tie. Communications relative to this improvement should be addressed to Mr. Lyman C. Garretson, No. 63 Dey Street, New York City.

AN organist says that a cow moos in a perfect fifth octave, or tenth; a dog barks in fifth or fourth; a donkey brays in a perfect octave; and a horse neighs in a descent on the chromatic scale.

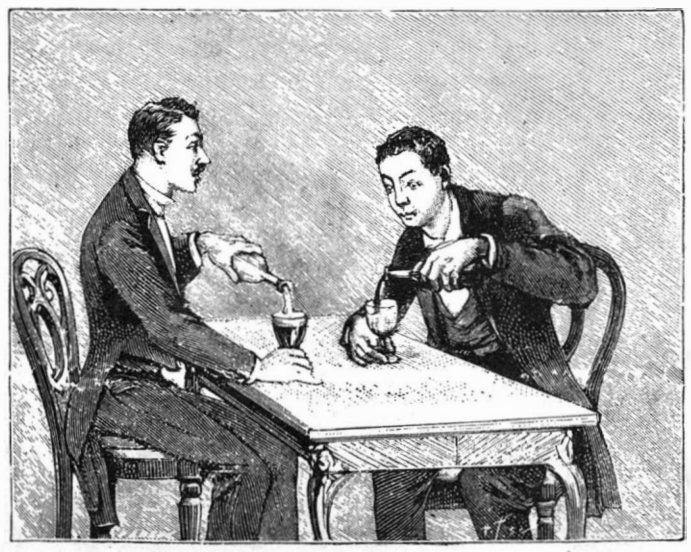


FIG. 4.—WATER CHANGED INTO WINE AND WINE INTO WATER.

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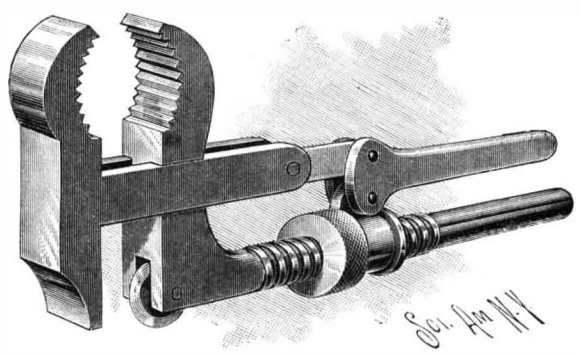
AN IMPROVED WRENCH AND CUTTER.

A tool adapted to use as a wrench for ordinary purposes, and also as a pipe wrench or pipe cutter, is shown in the illustration. It has been patented in the United States, England and Canada, by Mr. Theodore Fletcher, of Macdona, Texas. The shank or handle of the wrench, which is integral with its inner jaw, has a screw-threaded portion on which is mounted a spool-shaped nut, carrying a collar to which is pivotally connected a lever, the latter being pivotally connected by means of a link with the shank of the outer jaw.



FLETCHER'S WRENCH AND CUTTER.

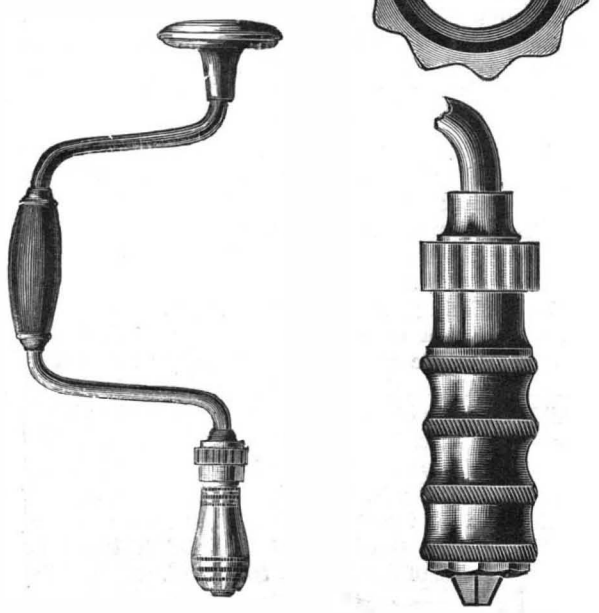
Both jaws have at one end flat surfaces, to engage a nut, while at their other end they have concaved toothed surfaces to clamp a pipe. A removable rotary cutter is secured on a pin in a recess in the flat surface of the inner jaw. By gently squeezing the handles together, after the jaws have been adjusted upon a nut or pipe, an exceedingly firm grip is obtained, its pressure increasing with the strength of the pull, while the jaws may be automatically opened by slackening the hold upon the two handles, thus enabling the tool to be used almost as a ratchet wrench, and saving much time. When the cutter is to be used, after adjustment with the wheel in place, the lever affords means of bringing all the force desired upon the cutter.

Discard the Old—Get the Best.

Only a practical man can appreciate the immense advantages which arise from the use of good machinery. To the manufacturer whose capital accrues large interest through the aid of his employes and machinery, it may seem unreasonable that machinery, which in his estimation should last forever, rightfully belongs to the scrap pile. A little common sense, and just a bit of mathematical computation, however, says the *Woodworker*, will usually abolish such illusion. Notwithstanding the most careful attention that can be given it, the time surely comes in its life when age and the effects of repairs render a machine unfit for further service.

AN IMPROVED CORRUGATED BIT BRACE RING.

The illustrations represent an improved form of corrugated ratchet ring for bit braces, which is being manufactured and put on the market by the American Bit, Brace and Tool Company, of Buffalo, N. Y. The ring, instead of having its outer surface knurled or



IMPROVED BIT BRACE RING IN PLACE.

milled, as usual heretofore, has a corrugated surface, as more plainly shown in the small sectional view, the other views showing the ring in position on the brace. This form of ring is designed to enable the workman to obtain a firmer grip in using the brace, being deemed especially advantageous when the hands are moist or greasy. The improvement will commend itself particularly to plumbers and linemen, as well as to carpenters and mechanics generally.

HYDRAULIC PROPULSION OF VESSELS.

Improved means of applying the jet principle in the hydraulic propulsion of vessels are shown in the accompanying illustrations, Fig. 1 being a sectional and Fig. 2 a plan view of a jet-propelled vessel patented by Mr. James C. Walker, No. 1741 De Sales Street, Washington, D. C. Main pipes, A, one on each side, open into the water at the bow, and extend back through the boat near the keel, having a slight decline and diminished size from bow to stern, where they discharge. Smaller pipes, B, extend from the main pipes through the sides of the boat, where they terminate in nozzles which may be turned in any direction by means of levers, C. Air and waste water pipes, D, lead from near the bow to a well or reservoir, E, at about the lowest point in the bottom of the boat, to draw in pure air and remove water from the front part of the boat. From this reservoir a waste water pipe, F, extends close to the keel to an outlet near the stern, and other pipes, G, H, lead from the reservoir to an outlet at the stern above the water line. In the main pipes, A, near the bow, are force water wheels or propellers, each having a rim fixed to the outer edges of its blades, so that the wheels will work close to the inner surfaces of the pipes, and these propellers force the water through the pipes, branches and nozzles, with great velocity. The stern nozzles are straight, but so jointed to the main pipes that they may be readily turned to the right or left by levers connected with the engine room or pilot house, the vessel being thereby steered with great facility. There are valves in the main pipes to shut off water from the front in case of accident or when at the wharf, and valves, I, in the main and suction pipes, are adapted to shut off water from the stern nozzles when the vessel is moving backward or standing still. By means of the side nozzles the boat may be steered in any direction without rudder or using the stern nozzles, and if the boat should get aground, the directing of the nozzles down-

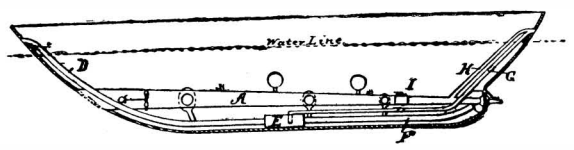


Fig. 1.—WALKER'S JET-PROPELLED VESSEL.

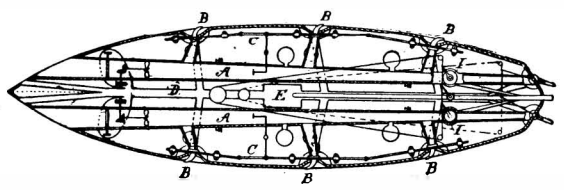
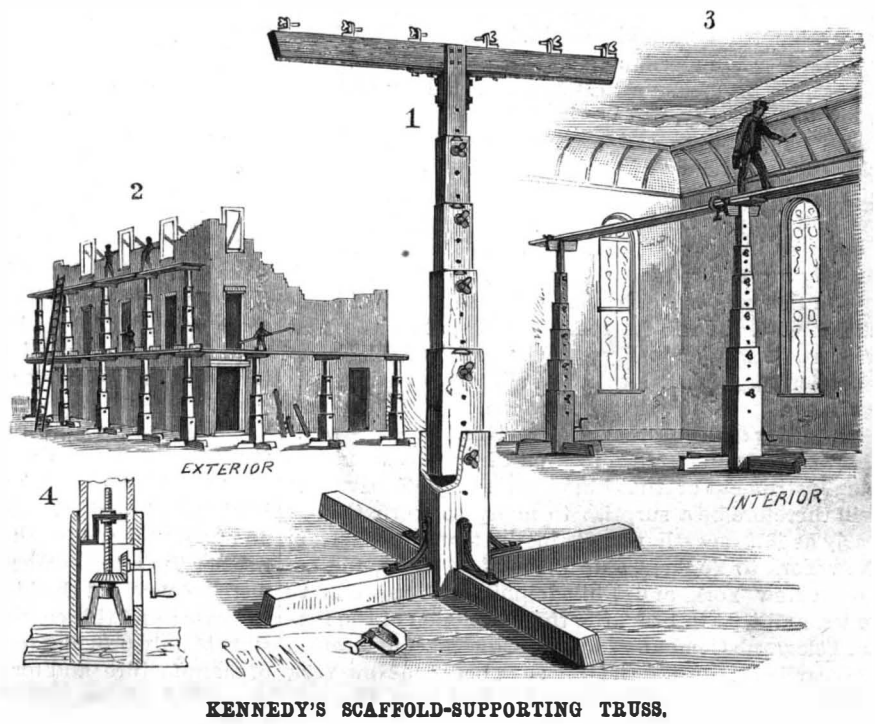


Fig. 2.—WALKER'S JET-PROPELLED VESSEL.

ward would not only tend to lift the boat, but to scour out the bottom under it. The drawing in of so much water at the bow, thus saving the force which would otherwise be required to push this water out of the way of the vessel, is designed to be especially advantageous, the force thus expended also operating as a suction to draw the vessel forward.

AN IMPROVED SCAFFOLD TRUSS.

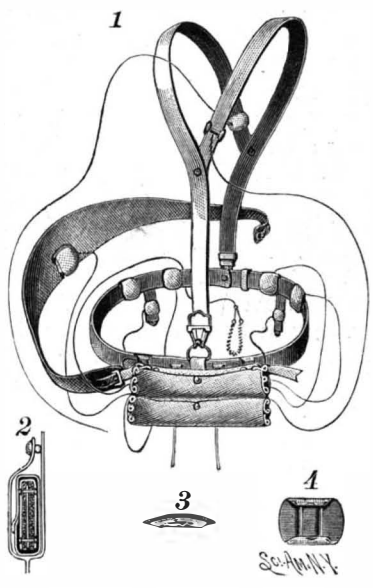
The construction and use of an adjustable telescopic scaffold truss, to facilitate the repair of ceilings and all kinds of outside work upon buildings, are represented in the accompanying illustration. The improvement has been patented by Mr. Thomas Kennedy, No. 279 West 118th Street, New York City. Fig. 1 shows the truss in perspective, Figs. 2 and 3 illustrating its use, and Fig. 4 being a section of its lower portion, showing how a close adjustment of the truss may be made for a particular elevation. The telescoping sections are similarly constructed, of consecutively diminishing size transversely, and the whole is mainly of wood, so that it may be readily built by any carpenter. The several sections are vertically adjustable by means of bolt holes in opposite sides, through which are passed detachable screw bolts, fitted with locking nuts. For a nice adjustment, after the truss has been extended to the approximate height desired, the bottom section is fitted with a crank and gear, actuating a screw, as shown in Fig. 4, by means of which the other sections may be collectively raised or lowered. The top section is provided with short or long heads for the support of the scaffold floor, the planking of which is held in place by screw irons on the head, and a screw clamp is provided for readily binding in place top planks or stretchers. The adjustment of all the parts is effected without the use of a nail, so that the scaffolding may be readily put up and taken down with little or no noise, and the entire structure, when not in use, can be closed up, so as to occupy but little space.



KENNEDY'S SCAFFOLD-SUPPORTING TRUSS.

AN IMPROVED ELECTRIC BELT.

A belt to be buckled around the waist, and supported by shoulder straps, the belt carrying a battery and attachments for sending a current of electricity through the body in the treatment of acute and chronic diseases, is shown in the illustration, and has been patented by Dr. George F. Webb, of Cleveland, Ohio. Fig. 1 represents the complete apparatus, Fig. 2 a cross section through one of the batteries and its case, and Figs. 3 and 4 a cross section and inverted plan of one of the electrodes. The battery cases at the back of the belt are attached thereto by buttons, any desired number of such cases being used, and each battery is in a waterproof pocket, preventing injurious effects from the acid. The battery consists of a number of connected elements hinged together to conform to the movements and shape of the body, the elements comprising a central copper plate, inclosed by a jacket of absorbentinsulating felt, and an outer double zinc plate. The several elements are connected together by copper hinges, so that the entire force of the battery may be used when necessary, the hinges connecting the zinc plate of one element with the copper plate of the next, and suitable terminals are provided for the attachment of conducting cords or wires. An adjuster or cut-out is also provided for use in case only a portion of the battery power is required. Connected with the battery by the conducting cords are the electrodes on different parts of the apparatus, to contact with the body. The electrodes are preferably made of aluminum, of oval convex shape, as shown in Figs. 3 and 4, and are bent to form a clasp readily engaging the belt or straps on any desired part of the breast or back. A neck band is also provided on which an electrode may be used, the electrodes being arranged according to circumstances to contact with the necessary parts of the body, while the amount of the current is regulated by the adjuster.



WEBB'S ELECTRIC BELT.

An Improvised Aspirator.

Dr. Smith, in the *Medical Record*, says an aspirator which any one could make had been first used by him during the civil war. Take a quart bottle, a tightly fitting cork, pierce the latter with a glass tube, attach to this one end of a rubber tube and the other end to an aspirator needle. Put a drachm of ether into the bottle. Put in the stopper, set the bottle into hot water, and when the ether has become vapor, take it out of the water, introduce the aspirator needle, and as the ether condensed on becoming cool, it would form almost a complete vacuum in the bottle, so that nearly a full quart of fluid would be drawn into it.

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Lamination in Metal.

Prof. John Tyndall contributes something new upon the subject of cleavage, as it occurs in crystals, rocks, ice and other bodies; and his studies lead inevitably to the conclusion that lamination results from the operation of the same laws under analogous conditions as those which produce the property known in mineralogy and crystallography as cleavage.

At first one would suppose wax, or baker's dough, to be most unlikely substances wherein to detect any tendency to cleavage; yet it is precisely with these materials, wherein plasticity is a most prominent physical property, that Prof. Tyndall has performed experiments that are commanding the attention of the scientific world, and the results of which have an important bearing upon the metallic processes. In these plastic materials and others, such as clay and graphite, Prof. Tyndall has proved that cleavage may be developed in as marked a degree as in slate—even the varieties of the latter used for roofing—by the simple application of pressure to the plastic mass. Cakes of wax that have been thus treated are easily split up into regular laminæ, so uniform in character as to excite the surprise and admiration of those who have witnessed the experiments.

These researches appear to have proved that any material, no matter how plastic or how homogeneous it may appear to be, has within it the condition for the development of cleavage, and that the only external condition necessary to produce lamination is a sufficient degree of pressure exerted in one direction upon the mass. The resulting planes of cleavage will be at right angles with the direction in which the pressure is applied. The philosophy of this effect lies in the fact that, as relates to the cohesion of its particles, no substance is strictly homogeneous; that is to say, the particles, granules or molecules of substances do not possess cohesive power equally in all directions; and hence, when pressure is applied to them, they slide over each other (the sliding surfaces being those of least cohesive power) and move toward a point of less pressure. In the case wherein pressure is applied in one direction only, the sliding will be in a direction at right angles with the direction of the pressure, and thus plates, laminæ or strata are generated in the mass, the limiting faces of these layers having less cohesion than their interior parts.

It is thus that under the action of the rolling pin flaky pie crust is formed. The same kind of stratification is formed in a biscuit, while in bread, the loaves of which are shaped by kneading, this stratification is absent, and a fibrous structure—called by bakers the "pile"—results from the difference in the manipulation. It is entirely indifferent what kind of material is thus operated upon, provided that it will in some degree yield to pressure without crushing into powder; the result of pressure exerted in one direction more than in any other will result in lamination more or less marked. An illustration of this kind of action is found in iron and other metals. When iron undergoes the ordinary process of rolling it is taken at a welding heat from the furnace, and the uniformly distributed heat weakens the cohesive power of the particles quite equally throughout the mass; the result is a fairly homogeneous bar or plate. However, in bars the tendency to longitudinal stratification is manifest, and when the bars are cold and cohesion has again been restored to its normal power, it can always be found that iron so produced is stronger longitudinally than laterally.

The Bell Telephone Instrument.

This patent expires and becomes public property in 1894. The Bell receiver is in some respects a superior transmitting instrument, so the *Electrical World* says, to any of those especially designed for the purpose, in that it introduces no local disturbances, such as are inseparable from variable contacts. The microphone transmitter is, indeed, a convenience, but, as before stated, by no means an essential. For long distance work in telephony, as in other transmissions of electrical energy, high potentials are necessary, and for this purpose the use of the induction coil in connection with the microphone, to transform the local currents of low potential into those of high potential for transmission, was early adopted. But the same effect exactly can be produced by properly winding the coils of the Bell receiver with an additional number of turns of fine wire. It will be remembered that for the first year and a half or two years of the art of telephony the microphone was not used at all. Two instruments exactly alike of the Bell type were employed, one as a transmitter and the other as a receiver. It is not, however, so generally known to what distance a transmitting instrument of that kind is generally effective. It will therefore be a surprise to many to learn that as early as 1879 speech was distinctly transmitted from New York to Yonkers, a distance of 25 miles, and between New York and Philadelphia, a distance of 90 miles, and that in 1883, after the completion of the Postal Telegraph Company's lines to Chicago, conversation was carried on during the day time between New York and that city, notwithstanding the fact that the wire was grounded at both ends. The wire used in this experiment was one of the regular wires used for telegraphic purposes by the Postal Telegraph Company, and was a compound wire composed of copper and steel, the former metal being employed to add conductivity, and the latter to give strength to the wire. Our recollection is that it was a No. 8 B. W. G. Conversation was also carried on at about the same time between New York and Cleveland, the Bell instrument being used in all these.

Decisions Relating to Patents.

REISSUE OF LETTERS.

In his affidavits accompanying an application for an original American patent the patentee swore that the invention was the same as that covered by a British patent issued to him in 1889. In an action for infringement of a reissue of this patent defendants claimed that the first claim of the reissue was identical with a prior English patent issued to the patentee in 1888. It is held by the Circuit Court that, even if this were true, and the affidavit consequently false, there being no other evidence of fraud, the whole of the reissue was not invalidated thereby, it appearing that the question of identity may have been a doubtful one, which the applicant would probably leave to his attorney. 1.

After the reissue of the original American patent, and before his application for the reissue, the patentee applied for a second American patent, swearing that the invention therein claimed had never been patented, with his knowledge or consent, in any country. This statement was untrue as to part of the claims, for they had been described in the English patent of 1889. The Circuit Court decides that this false statement, in the absence of the other elements of an estoppel, did not preclude the patentee from asserting the claims of the reissue.

The court also rules that the fact that the claims of the reissued patent No. 11,153, granted March 24, 1891, to John B. Dunlop, upon original patent issued to him, September 9, 1890, for pneumatic cycle tires, omitted certain strips of elastic material, which, by the original patent, were to be inserted between the edges of the wheel rim and the strengthening folds enveloping the tire, so as to protect these folds from injury by the edges of the rim, did not invalidate the reissue by thus broadening the claims, for these strips were not essential to the combination, and did not involve inventive skill, and it appeared that no adverse rights accrued in the meantime, and that the reissue was applied for within four and a half months from the date of the original. 2.

The Circuit Court lays it down that reissued letters patent No. 10,600, granted May 26, 1885, to the Carpenter Straw Sewing Machine Company, as assignee of Mary P. C. Hooper, upon original letters patent dated January 4, 1876, for improvements in straw braid sewing machines, are void as to the amended fifth claim, wherein a new element, viz., a lip, is added to the combination claimed.

The court also holds:

(*a*) Where a claim in reissued letters patent covers a combination to which a new element has been added, it is in legal contemplation "broadened," and is invalid when it covers machines used for long years by innocent parties, without infringement of the original patent, with the knowledge of the patentee, and without interference by him.

(*b*) Even where the invention covered by reissued letters patent is described in the original and the claim of the reissue is narrower, but covers machines used for long years by innocent parties without molestation and without infringement of the original patent, such narrowed claim is void.

(*c*) For a reissue to be valid as covering "the same invention" as that in the original, within the meaning of Rev. St. § 4,916, the patentee must have described and intended to secure in the original the invention of the reissue. 3.

DESIGN PATENTS.

Letters patent No. 408,416, issued to William C. Krick, are for an improvement in floral designs, whereby, instead of tying single flowers to a toothpick and sticking them into a floral piece, so as to form a letter or design, the letter or design is first cut out of some stiff material, the flowers fastened to it, and when the form is complete it is fastened to the floral piece by toothpicks. It is held by the Circuit Court that a want of patentable novelty is not so manifest on the face of the patent as to render a bill for infringement demurrable. 4.

The Circuit Court decides that design patent No. 20,347, issued November 25, 1890, to Frederick Bergner, for an album case set upright on a baseboard, and having on its exterior an oval ornamental frame, with an open center, is invalid, since the patentee invented neither the album case nor the ornamental frame, but merely conceived the idea of placing the ornament on the case; and this conception is not patentable, for the statute only provides for patents on designs for articles of manufacture and for ornaments to be placed upon or worked into such articles. 5.

PATENTABILITY.

The United States Supreme Court holds that the first claim of letters patent No. 224,991, issued March 2, 1880, to A. W. Brinkerhoff, for an improvement in "rectal specula," consisting in a slide extending the entire length of the tube, is void, in view of the prior art; and the fact that the slide of the patent is of metal, while former slides were of glass, is immaterial, since the material of which the slide is composed was not claimed as an essential feature of the device. 6.

It is held by the Circuit Court that letters patent No. 303,116, issued August 5, 1884, to Sarah Caverly, for a machine for rounding bent handles, consisting of a cylindrical cutter head, revolving vertically, having in the center of its periphery a groove, with cutter knives set diagonally, and adjusted from both sides of the cutter head into the groove, are void for want of novelty, such cutter heads, either made in a single piece or made of two disks, having been in use long before the date of the invention. 7.

The Circuit Court rules that the 5th, 6th, and 7th claims of reissued letters patent No. 8,765, dated June 24, 1879, to Jay S. Corbin, for an improvement in wheel harrows, consisting of the combination with a gang of rotating harrow disks of a lever for setting the same, are void for want of novelty, the improvement being merely a change in the location of the lever previously used. 8.

The Circuit Court of Appeals lays it down that the first claim of letters patent No. 154,293, issued August 18, 1874, to William Starling, for an improvement in sulky plows, consisting of the combination of a crank bar with the plow beam, lever, and axle, so that the horses are made to raise the plow out of the ground, is void for want of novelty. 9.

It is held by the Circuit Court of Appeals that letters patent No. 354,717, issued December 21, 1886, to P. P. Mast, for an improvement in cultivators, consisting in the construction of couplings by which the beams and alignment rods are connected with the axle, and in the construction of the beam brackets and crossheads which carry the shovel standards at the point where the brackets and standards join, so as to maintain the alignment between the shovels and the axle, irrespective of a change in the lateral position of the shovel beams, are void for want of novelty. 10.

1. Featherstone *v.* G. R. Bidwell Cycle Co., 53 Federal Reporter, 113.
2. Same.
3. Carpenter Straw Sewing Machine Co. *v.* Searle, 52 Federal Reporter, 809.
4. Krick *v.* Jansen, 52 Federal Reporter, 823.
5. Bergner *v.* Kaufmann, 52 Federal Reporter, 818.
6. Brinkerhoff *v.* Aloe, 13 Supreme Court Reporter, 221.
7. Caverly *v.* Deere, 52 Federal Reporter, 758.
8. Galt *v.* Parlin & Orendoroff Co., 52 Federal Reporter, 749.
9. Starling *v.* Weir Plow Co., 53 Federal Reporter, 119.
10. P. P. Mast & Co. *v.* Rude Bros. Mfg. Co., 53 Federal Reporter, 120.

Period of Infection in Mumps.

The question as to the transmission of the infectious diseases and the exact stage of the disease at which infection is most likely to occur has been satisfactorily settled regarding most of the exanthemata. In mumps, however, the case is different, some authorities maintaining that the disease may prove infectious throughout the whole of its course, while others are of opinion that this is only the case at the commencement of the attack. Dr. Rendu, in a paper read before the Société Médicale des Hopitaux, related two cases which are valuable as throwing light upon this point. A young lady visited her mother on Jan. 2, who complained of slight malaise; on the following day, however, she developed mumps. On Jan. 24 her daughter, who had seen her on the second, but not since, was likewise attacked. In the interval she had seen no person who who was suffering from the disease. Dr. Rendu argues, therefore, that a case may be infectious even before the characteristic parotid swelling has made its appearance. A second case was very similar to this one. A child ten years old was attacked after being in company with a friend who, although then showing no signs of the disease, was found a few hours afterward to be suffering from it. Mumps is, therefore, evidently infectious at the termination of the period of incubation. Dr. Rendu is of opinion that infection is conveyed by means of the breath.—*Lancet.*

IN an interview on the subject of the extensions and alterations of the elevated railway system by a *Tribune* reporter with one of the directors, the latter evidently expressed himself somewhat differently from what he intended.

Reporter: "Do you think the present elevated structure strong enough to support the further weight of three tracks and more rapid trains?"

Mr. Sloan: "Certainly; you have no idea of the anxiety with which our engineers watch the present structure. It is carefully examined continually."

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Correspondence.

The Cause of the Density of Snow.

To the Editor of the Scientific American:

This last winter I had occasion to observe the cover of snow in the State of Moscow. Although last winter we had no thaw, the snow in some places presented a very dense mass. The snow presented the greatest density in the places exposed to the greatest squeezing of the wind, whose force depended upon the force of the wind and upon the angle of the meeting of the wind with the surface of the snow. But in protected places, in hollow ways, in forests, etc., the snow always was extremely light and tender. Though the squeezing of the wind is sometimes not very strong, in a great space of time it can strongly press the snow. N. SMIRNOFF.

St. Petersburg, Russia, Physical Laboratory of the University, April, 1893.

How to Cement Wood to Glass and How to Bore Holes in Glass.

To the Editor of the Scientific American:

Having had occasion to cement wood to glass, so that the joint would stand changes of temperature, I thought perhaps your readers would like to know how it was done. In making a Wimshurst influence machine, the hubs were of wood, and every winter the cold made the cement all strip clean from the glass.

I took some gummed labels, such as druggists use on prescription bottles, and gummed them to the glass where I wanted my wood to be fastened, and allowed each label to dry on the glass, and nothing but a scraper or soaking in water will loosen it.

Then I cemented the hub of wood to the paper instead of the glass, and it holds strongly and permanently. Cement for this purpose may be made of virgin rubber 2 parts, resin 1 part, and gum shellac 2 parts, all melted together and applied hot.

I notice in the SCIENTIFIC AMERICAN more or less inquiry how to drill glass plates. I'll tell you my way:

Take a small common three-cornered saw file and break off an inch of the end of it. Then take to a grindstone and grind a blunt, triangular point on it, being careful not to hurt the temper. Leave the file in the handle and bore just like you would with an awl. The point of the file should not be longer than the file is thick. Use turpentine as a lubricant, and keep the cutting edges on point of file sharp with an oil stone. I have bored holes 2 inches deep in a short time by hand in glass by this method. In boring a plate, I have found it best to bore from both sides, using very light pressure toward the last, always laying the plate solid on a paper-bound book. M.

Palmer, Neb., April 10, 1893.

Electric Smelting and Casting.

Mr. George Ambrose Pogson, the British vice-consul at Hamburg, reeently explained to a number of gentlemen who visited him at the Wharncliffe Hotel, Sheffield, the "Taussig" system of smelting and casting metals in exhausted chambers. The system is claimed to produce, by a single process, every 15 minutes, with an expenditure of 360 cwt. of coal per 1,000 cwt. of finished cast metal, bronze, iron, steel, copper, brass, zinc, platinum, gold, or silver, free of pores or bubbles. The process is effected by electricity by means of flat metal electrodes in an exhausted furnace, large moulds being set up outside the furnace, and exhausted by one process simultaneously with the exhaustion of furnace. Castings up to 30 pounds of iron have been made in the presence of her Majesty's representatives at Hamburg within 15 minutes, the air pump in use showing 92 per cent exhaustion of air; ampere gauge, 2,500; voltage, 2½ volts.

The electric current does not effect its work from outside through surface of crucible or furnace, but by conduction through the metal itself which is about to be smelted. Siemens-Martin steel is fused without any other parts of the electric current undergoing any material increase of temperature. By use of metallic electrodes all contamination of metal by carbon is absolutely avoided, as coal slack is not present in any large quantity, refuse is reduced to a minimum, and oxidization and creation of air bubbles are, it is contended, by this new method of smelting in a vacuum, by means of removal of carbonic acid gas, etc., also avoided. The metal becomes more liquefied, and, on account of the casting forms being denuded of air, permits of extremely close and fine casting, even of objects of excessively small diameters. Among other pertinent justifications for these assumptions is the fact that the samples which have up to the present been tested in the proof-rooms of the Royal Technical School at Charlottenburg, near Berlin, have, notwithstanding the prejudicial circumstances under which they have been produced, according to a copy of the government report in regard to such tests, shown very satisfactory results. From the nature of the system adopted it ensues that the electric force which is carried out with currents of great strength, but low voltage, is attended with absolute freedom from danger. Small iron propellers and similar objects are constantly melted and cast at Bahrenfeld in the presence of witnesses within a period of 12 to 15 minutes. Currents of 20,000 to 30,000 amperes are no exaggeration, and exhaustion of air from the largest chambers now presents no difficulty.

By the employment of 30,000 amperes and 50 volts, a force equivalent to about 2,000 horse power, or somewhat less than that used by the aluminum works at Neuhausen, on the Rhine, the casting form would have a minimum length of 12 meters and a width of 1½ meters. This would give a body of metal of 180,000 cubic centimeters, or about 1½ tons. According to the experience gained in experiments at Bahrenfeld, such casting would be effected in one process, lasting in all not longer than a quarter of an hour. The expenditure of coal is, therefore, in round figures, but 50 per cent of that necessitated by the most perfect system at present in use. The use of water power naturally increases these advantages in an enormous extent. The iron furnace seen by Mr. Pogson at Prof. Taussig's works at Bahrenfeld consisted of a rectangular vessel, 6 feet by 3 feet by 3 feet. Two electrodes, apparently of wrought iron, were placed upright inside the furnace, so that their surfaces of 8 inches by 4 inches faced the arc-shaped piece of iron which was to be fused; a channel of clay served the purpose of conducting the fused metal from its clay melting bed into the empty clay mould of a model propeller, the mould in question being placed at a lower altitude in the other empty iron furnace.

The wires connecting the flat metal electrodes with the powerful generating machinery put up by Messrs. Schuckert & Co., the well known German electrical engineers, were already in position, as was also the exhaust pipe connecting the furnace with a steam air pump of about 20 horse power, which also drove the dynamos. Having personally placed the 30 pounds of pig iron in the clay bed, placed parallel with, but a few inches in front of, the flat electrodes, the cover of the oven was swung on; the necessary exclusion of external air being effected by India rubber pads fastened to the furnace cover. Punctually at noon the cover was fastened down, and the pump set working, the current being switched on at the same moment. The indicator of the exhaust pump soon showed an exhaustion of 92 per cent of air. The electric indicators showed respectively 2,500 to 3,000 amperes and 2 to 2½ volts. The gradual approach from red to white heat could be followed from the eyelets in the furnace. Fusion was obtained at about 12:8, the indicators showing great unsteadiness until the resistance had been reduced to nil by the current being allowed to pass freely through the fused metal. At 12:14 the furnace was opened, and a minute or two later the clay was being chipped off and a perfect cast of a propeller was exposed to view.

Identity of Light and Electricity.

From the experiments recently performed in electrical oscillations, the conclusion that light and electrical oscillations are identical is very strongly substantiated. The principal parts in which they practically agree are the velocity, rectilinear propagation, laws of reflection, interference, refraction, polarization and absorption by material substances. In fact, the sole certain difference appears to be the wave length. There is difficulty in producing continuous electrical oscillations of less than a foot in length, while light is about the hundred thousandth part of an inch. The only difference between them is that our eyes will appreciate the short ones, but are not affected by the long ones. The great question for electrical engineers is to produce these very short wave lengths directly. Hertz by the induction coil and condenser, and Tesla with a specially designed multipolar dynamo, have produced similar waves, which will set molecules in a rarefied atmosphere into such rapid vibration as to produce light. But the great question has advanced only one step. Probably neither of these methods will furnish more than a suggestion to the real solution. A simple computation will show that by the Hertz method, in order to produce directly vibrations capable of affecting the retina, the condenser would be of nearly molecular size; on the other hand, by the Tesla method, the dynamo necessary would be a mechanical impossibility. However, the outlook is encouraging, and any work done along these lines cannot be otherwise than of benefit to science and to practical engineering.

In the domain of wireless telegraphy this subject is of prime importance. Much has already been done in this direction, and much more will undoubtedly be done by the aid of electrical oscillations of high power and frequency. The Edison method of telegraphing from moving trains is probably the best known practical application of electrical oscillations in air to commercial practice. Betts' method of telegraphing between ships at sea is another well known application, and depends upon the transmissibility of electrical oscillations through water. Although these methods are far from perfect, the end seems not distant, and we can confidently expect that in the near future we will be able to telegraph on land and sea without wires with great ease by means of electrical oscillations of high power and frequency.—*E. S. Ferry in Electrical World.*

Liquid Oxygen.

The phenomena presented by liquid oxygen promise to furnish science with additional data for the completion of chemical, electrical, and magnetic theory. Prof. Dewar, who has made special research into the properties of liquid gases, has already produced small quantities of liquefied oxygen obtained under great pressure at very low temperatures, and has remarked the sky-blue color and the considerable magnetic properties of this body. But its extremely low boiling point, 182° C. below zero, has hitherto prevented any appreciable quantity of oxygen remaining long in a liquid state, and the intense ebullition which occurs has rendered experiments on its magnetic and other properties difficult to accomplish. Recently, however, before a large and distinguished audience at the Royal Institution, Prof. Dewar kept, during the whole of his lecture, a globe the size of an egg filled with liquid oxygen in a tranquil state below its boiling point, evaporating slowly as water at ordinary temperatures. This result he accomplished by the discovery that by surrounding the vessel containing the liquid by an extremely high vacuum, the influx of heat-vibration from the outside air is reduced one-seventh, as is indicated by the amount of escape of gas; or by further precautions even to a still lower amount. The vacuum must be high in the extreme meaning of the term, for Prof. Dewar has produced vacua measurable not in millionths but in hundred-thousand-millionths of an atmosphere, and by means which exhaust a large vessel more quickly than the mercury pump exhausts the smallest. The difference in temperature between the globe of liquid oxygen and the air of the theater was not less than 210° C., yet the globe remained four-fifths full of liquid by reason of its vacuum jacket at the conclusion of the lecture.

The experiment leads to some interesting considerations as to the principle of radiation across interstellar space, as our own world has its "vacuum jacket." The crucial experiment would be an hermetically sealed bulb of liquid oxygen, self-poised in the center of a perfect vacuum—an experiment impossible under present conditions (unless the magnetic properties enabled the bulb to be so poised). There is always some connection between glass spheres and their support, as well as convection and conduction of heat at the evaporating surface.

The liquid oxygen so obtained becomes the means of further research in liquefaction of gases. Prof. Dewar showed that atmospheric air can be condensed into a liquid at ordinary pressure by the cold of liquid oxygen boiling under the air pump. But the liquid air itself can be produced by other means, and the cold of one superposed on the cold of the other may enable the final task of liquefying (and possibly solidifying) hydrogen to be eventually accomplished.

The essential difference between a liquid and a gas of identical composition was illustrated by the behavior of atmospheric air. Air liquefies as a whole with the usual proportions of oxygen and nitrogen. But when liquid air is allowed to boil the nitrogen distills off first, showing no appreciable admixture of oxygen until half the liquid has evaporated. Liquid air behaves in the magnetic field and in the spectroscope like dilute oxygen, and the color is simply a more watery blue.

The most interesting part of Prof. Dewar's researches from the electrical point of view, undertaken in conjunction with Prof. Fleming, could only be alluded to in the lecture. It is found that pure metals reduced to these abnormally low temperatures increase in conducting power, perfectly pure metals showing a conductivity increasing as the temperature falls in such a manner that all the temperature curves, if produced, would pass through the zero of absolute temperature. Electricity would pass through a wire of pure metal in interstellar space absolutely without loss. But the smallest impurity or alloy destroys this condition of perfect conductivity. On the other hand, non-metallic bodies so cooled show a conductivity decreasing with the fall in temperature. These investigations await interpretation. Meanwhile, science is furnished with another test of purity of element. Nickel prepared in the ordinary way does not conform to the law, but nickel deposited by Mr. Mond's process, from its combination with carbon monoxide, obeys this law perfectly. We do not yet know what an "element" is, but the experiments allow it to be stated that some at least of the chemical elements do behave in a manner totally distinct from compounds. At the low temperatures produced, chemical forces remain in abeyance, and oxygen becomes as inert as nitrogen. At a temperature that is conceivably possible to produce, all molecular motion ceases, and every gas becomes rigid. At —273° C., or absolute zero, hydrogen itself will become solid and all matter will become dead.—*The Electrical Engineer (London).*

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THE NAVAL PARADE AND REVIEW.

(*Continued from first page.*)

tion with which had been most appropriately set for this time. The Swedish singing societies, Swedish Mechanics' Society, and Swedish Art Society, with other organizations, participated, the presentation address being made by Mr. Ashley Cole and the acceptance by Mr. Paul Dana, while Col. William C. Church made a commemorative address. The statue stands about twenty-five feet from the water's edge, facing north, and is about seventeen feet tall from the base to the crown of the head. The base is of granite and a little over eight feet high.

The sculptor is Jonathan Scott Harley, and he was present at the dedication of his work. Four low-relief bronze figured panels are set on the four sides of the base of the statue. The one above the name Ericsson on the front of the base represents the battle between the Monitor and the Merrimac. Another shows a steam fire engine in action, another the steam war sloop Princeton, the first war vessel to have a screw propeller, and still another panel represents a number of Ericsson's inventions.

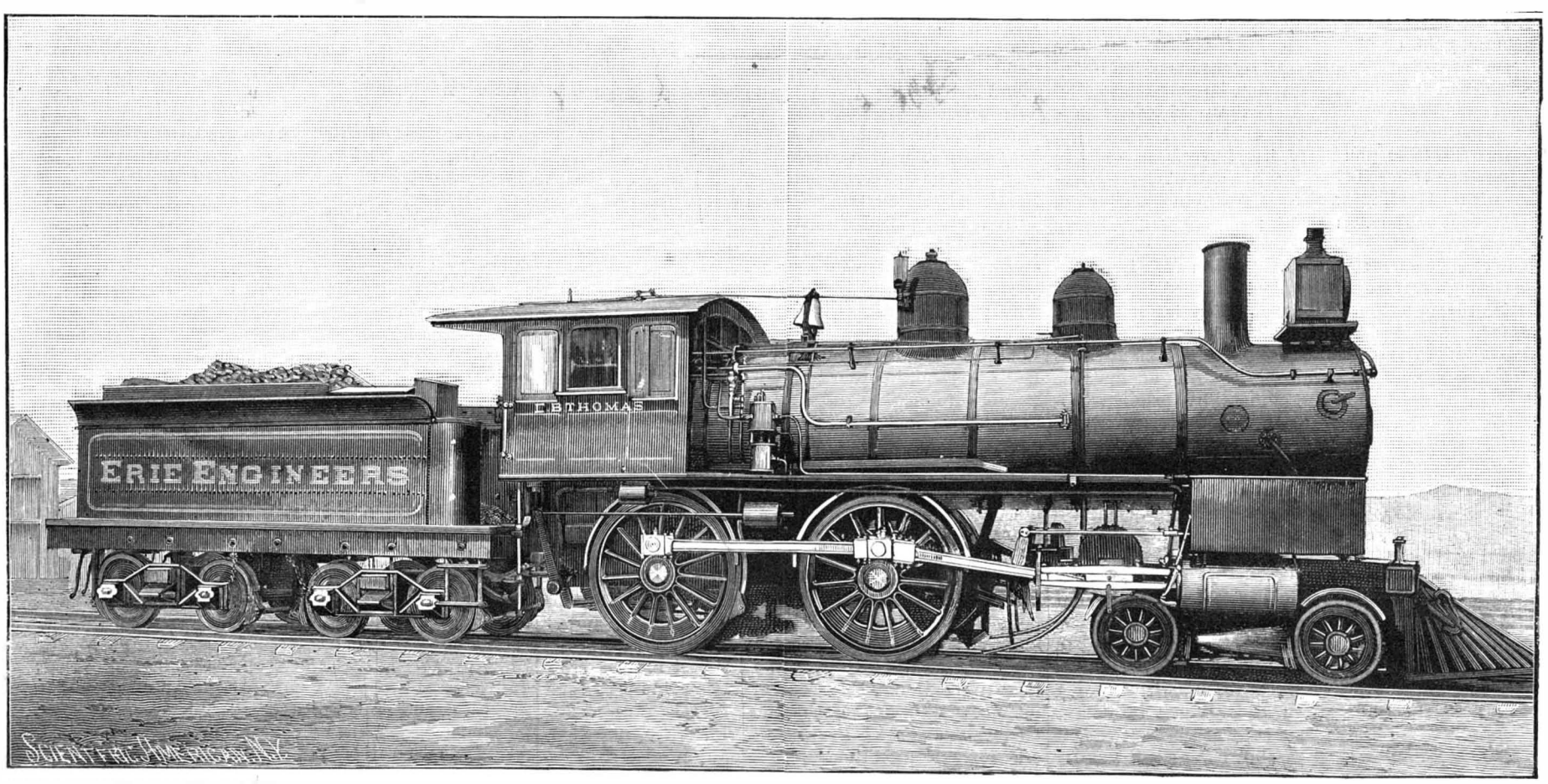
Perhaps one of the most noticeable and most warmly admired objects presenting itself to the eyes of the officers of the foreign war vessels, many of whom were on this occasion making their first entry to the harbor of New York, was the Bartholdi statue of Liberty, the illustration of which we herewith reproduce from a former issue of the SCIENTIFIC AMERICAN. This noble figure, greatly exceeding in size every other work of a similar nature ever projected, always appeals vividly to the imagination, and has commanded unstinted praise as a highly successful working out of a magnificent conception. The statue is made in *repoussé* of copper one-eighth of an inch thick, the envelope being kept in position by iron plates and braces. Its dimensions are: Base of pedestal, 62 square feet; from water level to top of pedestal, 149 feet; from bottom of plinth to top of torch, 151 feet; from heel to top of head, 111 feet; height of head, 13½ feet; width of eye, 28 inches; length of nose, 3 feet 9 inches; length of forefinger, 7 feet 11 inches. The torch, reached by a spiral staircase, will hold twelve persons, and the head will hold forty persons. It may be remarked that on one occasion a *bona fide* marriage service was performed in this portion of the statue.

The review of the fleet by the President on the 27th, which was designed to be the crowning feature of the Columbian festivities at New York, had been arranged to commence at 10 o'clock in the forenoon, but the rain was coming down so heavily all the morning that the hour was changed to 1 P. M. At this time the rain had ceased, and the President and his suite stepped aboard the Dolphin, one of the earliest built and smallest of our white cruisers, to pass in review and receive the salutations of the combined fleet. Our first page illustration gives a good idea of the scene. The little caravels were anchored at the north end of the line, between the two columns of which the Dolphin slowly moved from south to north, ship after ship shooting out red tongues of flame and belching forth clouds of smoke across her path, the vessel always seeming to be just emerging from the smoke of the opposing broadsides. The Miantonomoh, at the south end of the line, led this thunderous salutation, vessel after vessel joining in, each with a salute of twenty-one guns, as the Dolphin passed by, the President standing on the poop deck and lifting his hat as his vessel came abreast of each of the others. Arrived near the anchorage of the caravels, and between the big English ship Blake and our cruiser Philadelphia, the Dolphin dropped her anchor, and here the President held a reception. Nine admirals and thirty-five captains from the different ships, conveyed to the President's vessel by their gigs and boats, here came to do honor to the President and his party, which included the young mistress of the White House, and for the exchange of those civilities and friendly greetings which the people and the government of the United States can so independently and yet so cordially reciprocate with all the other peoples of the globe.

While this was taking place, the Philadelphia slipped her moorings and moved a little farther up to a point opposite General Grant's tomb, where a salute was fired in honor of the dead hero whom the nation so much delights to honor.

The review over, many of the officers came to the city to take part in a grand ball given in their honor, but the vessels remained at their anchorages, and vast crowds lined the shores to look upon a display of signal lights, flash lights, search lamps, and fireworks, which had been promised. In this exhibition all par-

THE COLUMBIAN NAVAL FESTIVITIES NEW YORK—THE STATUE OF LIBERTY.



THE WORLD'S COLUMBIAN EXPOSITION—THE ENGINEERS' LOCOMOTIVE—DESIGNED BY ENGINEERS OF THE ERIE RAILROAD.—[See p. 281.]

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ticipated, but the British ships led all the rest. Just before 8 o'clock the river around the four British ships the Blake, Australia, Magicienne, and Tartar, suddenly assumed the appearance of golden lakes. Somebody had pressed several buttons and the electricity had done the rest. The hulls of the ships, from water line to the rail, were outlined in globules of fire.

Simultaneously the electrician of the Jean Bart wove around her huge circular tops necklaces of golden beads. The Kaiserin Augusta revealed herself in bright dotted lines, and the Russian flagship arrayed herself in stars. Then came the exhibition of search lights. Electricians on every ship in the fleet stood to their work and sent their harmless charges through the mists. There was a stratum of fog extending a thousand feet or more above the river. Above that the air was clear, but above the cloudless stratum there was more fog. This condition of atmosphere caused many picturesque effects. The little caravels got a big share of attention. Every light on the leading ships was turned on the antique squadron, and they stood out like cameos.

Down the stream and up the stream the silver indices pointed; they gleamed across the historic river and lit up bits of the Palisades and startled folks in cottages along the Jersey shore. The *finale* of the search light exhibition was the concentration of all the glittering shafts on the American ships in one point in the sky. The signal for this display was made from the flagship Philadelphia by the Ardois lights, which flashed red and white in perpendicular strings from the masts. The meeting of the lights suggested a gigantic white-ribboned May pole before it is entwined by the ribbons. At the end of all the Blake showed a fiery figure of Washington, the man who led these colonies in war upon his kingdom. It lacked but an hour of midnight when this magnificent and most interesting display closed.

Although the President and many other officials of high and low rank were anxious to leave soon after the review, to be in Chicago at the inauguration of the Exposition on May 1, there was still a most important feature of New York's Columbian festivities to come off on Friday, the 28th. This was nothing less than a great land parade, such as has probably never before been seen in this or any other country, for it was a parade principally of men from all the different ships. Our own vessels furnished about fifteen hundred men, and about an equal number was landed from the foreign ships. There were bands without number, and some ten regiments of the New York State National Guard furnished the escort, but it was a sight well worth seeing and long to be remembered to view the contingents of English, Russian, French, German, Italian, Brazilian, Argentine and Dutch men-of-war's men swinging along Broadway, together with our own jack tars and marines, all like friends and compatriots, and all the foreigners doubtless forgetting any possible differences of their own in their generous admiration of and regard for the people of the country which Columbus discovered. And thus did New York execute its part of the inaugural work of the world's great Columbian Exposition for which Chicago has been so long preparing.

COST OF THE FAIR.—Auditor Ackerman has made a report showing that the building of the World's Fair has already cost $16,708,826, twice the sum paid for the Paris Exposition, and more must yet be paid out. There is at present a cash balance of $626,396, and $2,361,263 is due on contracts.

A MODEL LOCOMOTIVE.

Some time since it was determined by the locomotive engineers of the Erie Railroad system to join in the construction of a locomotive which should fully represent their ideas as developed in everyday practice in locomotive running. In this system there are between 950 and 1,000 locomotive engineers, who each subscribed for one or more shares of the stock in the engine, at five dollars per share. The result of this undertaking is illustrated by our engraving, which represents a first class passenger engine constructed according to modern ideas. It was built with the idea of exhibiting it at the World's Fair.

Our engraving is made from a photograph taken of the engine while it was being tested; consequently, the valve chest is shown covered with the box used to protect the indicators. This slightly mars the illustration, which in other respects is complete. Several of the great manufacturers of materials used in the construction of locomotives showed great liberality in furnishing some of the parts or the materials from which they are made. The Otis Steel Company presented the steel sheets from which the boiler is made. They are rolled to the thickness of five-eighths of an inch. The Midvale Steel Company gave the drive wheels, axles, journal boxes and side bars. The Snow Car Truck Company presented the pilot truck, and the Westinghouse Brake Company provided complete brake mechanism of the most modern type. The engine does not possess a great many points of novelty, but the variation from the ordinary construction is considered of great importance by these men, who are constantly using engines and know the various good and bad points of existing locomotives.

The total weight of the engine is something over 67 tons. This weight is distributed as follows: On the rear drivers 44,300 pounds; on the front drivers 44,450, and on the truck 45,850 pounds. The drive wheel axles are 8½ inches in diameter, the journals are 12 inches long, and the boxes are heavier than common. To permit of using journal boxes of this length, the wheels are dished, so that the spokes are outwardly convex. The crank pins are 6½ inches in diameter in the larger part and 5 inches in the smaller part, the cylinders are 19 inches in diameter and the stroke is 26 inches. The steam pressure will be 180 pounds. The wheel base is 48 feet and 9 inches, the boiler is of the straight cylindrical type, this form being deemed on many accounts preferable to the wagon top style. The expansion of the inner and outer parts being more uniform, unequal strains are avoided, and the principal cause of leakage is removed.

The brakes are applied at the front of the drivers, to avoid the strain caused by applying the pressure in the usual way.

This noble machine does credit to the engineers who conceived the idea of constructing a perfect locomotive, and to the army of practical men who contributed toward its construction. We understand that the engine is to be sold after its exhibition at the World's Fair at Chicago.

This creditable piece of workmanship was produced by the Cooke Locomotive and Machine Company, of Paterson, New Jersey, and we have no doubt it will be duplicated.

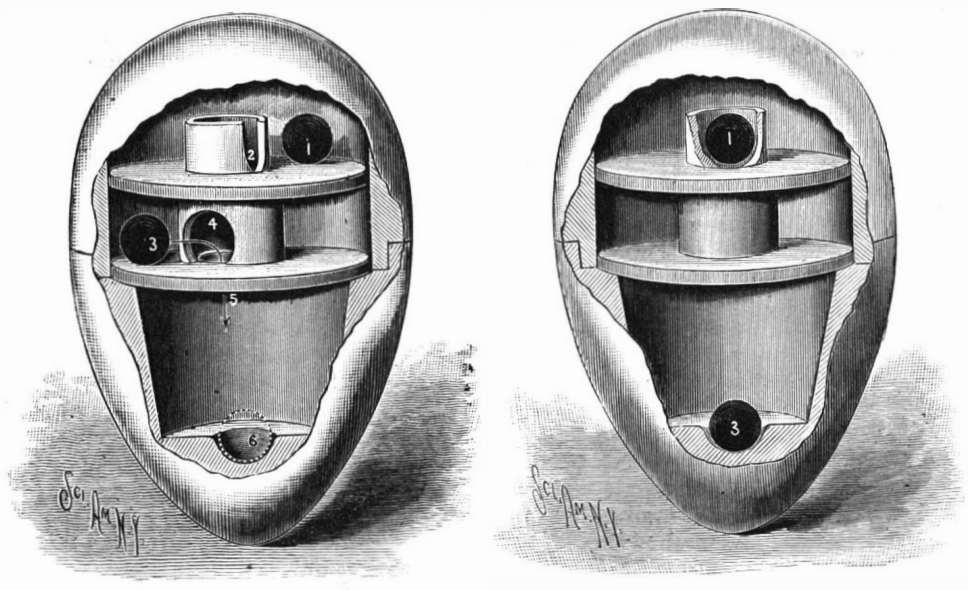
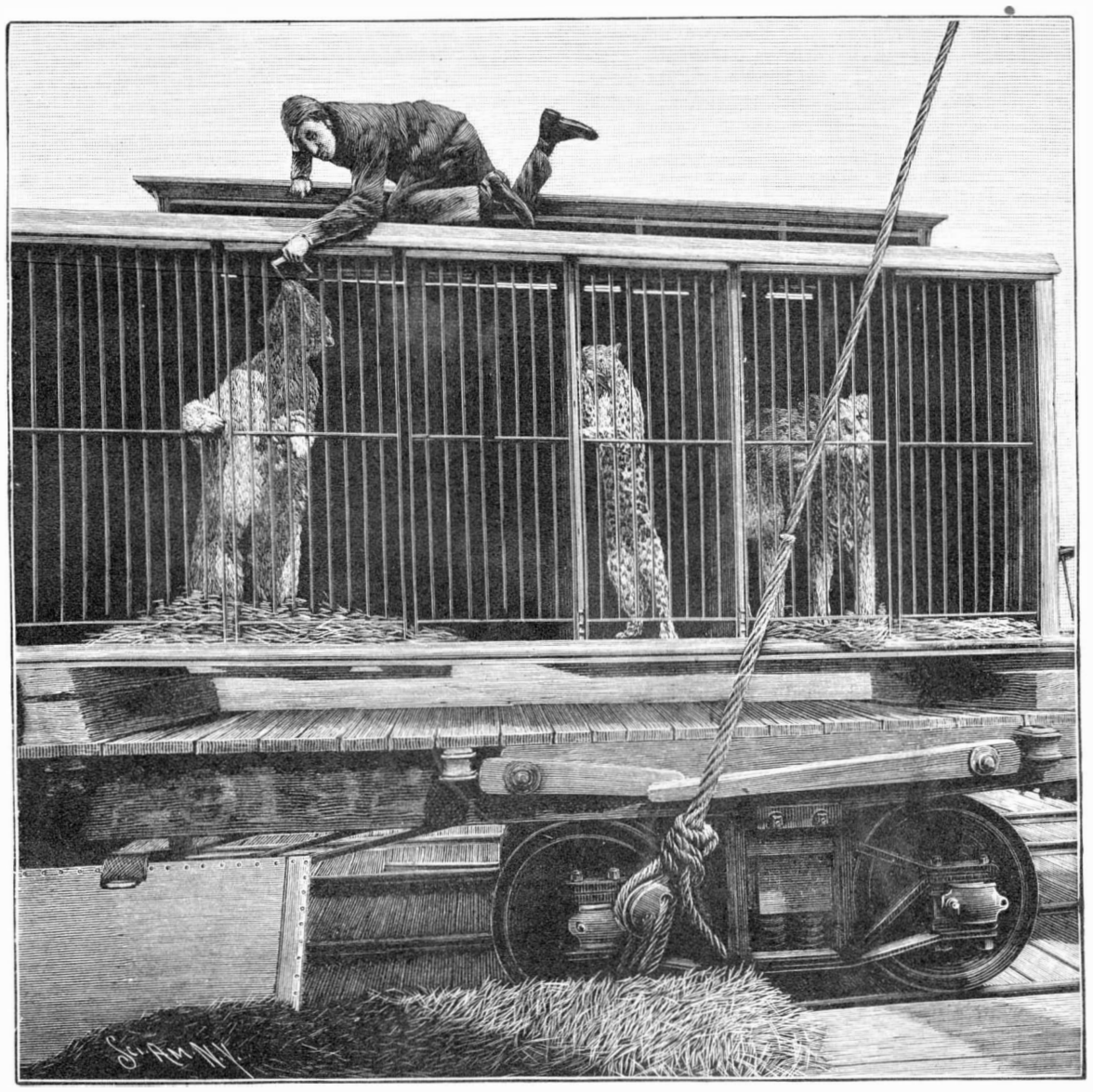


Fig. 1. BENITEZ'S COLUMBIAN EGG PUZZLE. Fig. 2.

A COLUMBIAN EGG PUZZLE.

The illustration represents a puzzle formed of a casing simulating an egg, with which may be accomplished the feat attributed to Columbus, that of causing an egg to stand on end, the shell of the casing being broken away and two views being given of its interior. A double-floored partition divides the larger from the smaller end of the egg, the floors of the partition being united by a hollow central cylindrical portion, in which is an aperture establishing communication with the annular chamber in the smaller end of the egg. Centrally on the upper partition, in the larger end of the egg, is a collar, open at one side, forming a chamber adapted to receive a ball. A ball is placed in the upper chamber and one between the floors of the partition, as shown in Fig. 1, and the egg can then be made to stand upon its small end by turning it around in the hand until ball 1 is moved into compartment 2 in the large end, ball 3 being at the same time guided through aperture 4 into the lower chamber 5, and to the cavity 6. The balls then will be in the line of the axis of the egg, and, its smaller end having a very slight cavity to give it a narrow base on which to stand, there will be no difficulty in making it stand on this end, as shown in Fig. 2. This puzzle has been patented by Mr. Manuel Benitez, and further information relative to it may be obtained of the Columbian Commercial Company, No. 126 Maiden Lane, New York City.



THE WORLD'S COLUMBIAN EXPOSITION—RARE ANIMALS FROM EUROPE EN ROUTE FOR CHICAGO.

IN his annual report for 1892, in respect of the Newton Abbot rural sanitary district, Mr. Harvey, in discussing the diminished tendency to spread of scarlet fever, puts it down, in a measure, to the free use of boracic acid, an ounce or two of which was given to each mother, with instructions for making an ointment by means of lard.

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Natural History Notes.

Climbing and Swimming Rabbits.—On the continent of Australia the rabbits, by force of circumstances, are obliged to modify their mode of life. These animals are often observed to climb trees in search of food when they cannot obtain it on the ground. At a recent session of the Zoological Society of London, Mr. Tegetmeier exhibited the fore paws of one of these Australian rabbits, which were seen to be adapted to this new mode of locomotion. It is found, in the first place, that they are more slender than those of the English wild rabbit. Their color is paler and the spots are dark. Besides, their claws are sharper and slenderer.

In the Australian rabbits differences have also been observed in the manner of raising their young. Thus, in certain localities, we find their ordinary seats, but in others the litter is placed upon the ground, without any covering. In summer they sometimes enter the water, with only their heads projecting above the surface. When they are pursued, during their migrations, they swim exceedingly well and cross the wide rivers with ease.

Ants Breeding In and In.—Forel announces that among ants of the genera *Anergates* and *Formicoxenus* there is no other male than a wingless ergatoid form, such as sometimes accompanies the normal male in other genera, and that, therefore, pairing must always take place in the ant hill itself between brothers and sisters; so we have here cases of perpetual consanguineous reproduction. "Among ordinary ants the winged male and female quit the nest in which they were born, take flight, and pair in mid air with their congeners of other nests, permitting numerous crosses. But in the case of the genera which have only an apterous male perpetual consanguineous pairing ensues, for in one and the same nest there are found only brothers and sisters and these brothers and sisters can only pair with one another. The fact appears absolutely clear in the genus *Anergates*, where one finds in each ant hill only a single fecundated female, the mother founder of the colony."

Distribution of Spiders.—Recent catalogues show that entomologists have found 363 species of spiders in the Upper Cayuga Lake Basin, 370 in the District of Columbia, and 340 in New England. Dr. George Marx has complied a list of 292 species which have been found in the polar regions of the globe, and after much study has reached these conclusions:

1. The Arctic spider fauna is composed of the ten families which we may term the common ones, their species constituting the main bulk of the entire spider fauna of the world. They are cosmopolitan, and are found almost wherever animal life is possible.

2. The genera of the Arctic spider fauna are, without exception, those which also occur in other regions of the world, and there has been found, so far, not one genus which is original to that zone of eternal ice and snow. This is a very remarkable fact, since in all other Arthropod orders, and those of higher rank, the polar fauna is distinguished by special and peculiar forms.

3. Even among this species a vast number occur which live in milder climates and under entirely different conditions and influences, and we find some families represented by only such forms, lacking entirely original Arctic species.

4. The differences between the faunas of the eastern and western hemispheres are slight, and, generally speaking those forms which are most frequently represented in one are found in the larger proportion in the other.

Coloring Matter of Pollen.—G. Bertrand and G. Poirault claim to have established the identity of the coloring matter of yellow or orange pollens of diverse origin with carotin, $C_{26}H_{38}$, the substance to which the color of carrots is due. From this generalization they exclude the dry pollens found in the *Urticaceæ*, *Graminaceæ*, etc., which owe their yellow color to the cutinization of their external membrane. The abundance of fatty matters present prevented the crystallization of the carotin of the pollen, but its iodide, $C_{26}H_{38}I_2$, was prepared. The colored crystal-like bodies that appear when pollen rich in oil is mounted in glycerine and examined microscopically are not composed of carotin, but of a fatty body, probably cholesterin, with which the oil is supersaturated.

The Number of Insects in the World.—It is believed, according to Mr. P. L. Simmonds, F.L.S., that there are five times as many insects as there are species of all other living things put together. The oak alone supports 450 species of insects, and 200 kinds make their home in the pine. Forty years ago Humboldt estimated that the number of species preserved in collections was between 150,000 and 170,000, but scientific men now say that there must be more than three-quarters of a million, without taking into account the parasite creatures. Of the 35,000 species in Europe, however, not more than 3,500 are noxious or destructive. There are more than 100,000 kinds of beetles. Such being an enumeration of the different forms, what an array of figures would be required for tabulating a census of individual insects, each a distinct living thing! Some single species include an incredible number of specimens. The locusts on the coast of the Mediterranean, for instance, sometimes cover the ground inches thick for miles, while a few years ago 14,000 bushels of locust eggs were collected in a single season in three Algerian provinces. A single house fly lays from 150 to 200 eggs, which in two weeks become equally fertile flies, and insects generally have astonishing powers of multiplication.

The Fertilization of Orchids.—J. H. A. Hicks, in discussing the fertilization of orchids without pollen, quotes Professor Henslow, who shows how a microscopical examination of the structure of the essential organs at once renders apparent the reason of so small an amount of good seed being set. The pollen, instead of being in well formed distinct grains, is arrested in development and, while the grains are still in contact, a common extine clothes the whole of each mass. Development does not proceed until the pollen mass has been placed upon the stigma. In the pistil, degeneracy is indicated by the prevailing parietal placentation and by the rudimentary character of the ovules, every part of which is degraded. There is no albumen or nucellus tissue to nourish the embryo, and the suspensor does its best to remedy this deficiency by elongating and escaping from the micropyle, then fastening itself like a parasite upon the placentas and extracting nourishment therefrom. As a result, myriads of seeds never succeed in developing even the pro-embryo.

The Autosporadic Seeds of the Yellow Sorrel.—The effective method that the yellow sorrel (*Oxalis stricta*) has of scattering its mature seeds, in which it proves to be a decided "touch-me-not," seems hitherto to have escaped observation. In Gray's Manual, and other like works, the seeds are spoken of as having a "loose and separating" coat, but the part this envelope plays in dehiscence and in the distribution of the species is not mentioned.

In May, 1891, Mr. Ernest Walker made some careful observations and the following memoranda:

As the seeds of *Oxalis stricta* L. attain maturity, the erect loculicidal capsule becomes flaccid. In this condition the least disturbance, as the touch of the hand or shaking by the wind, causes the seeds to be expelled with considerable force, and thrown two or three feet. Sitting for a few minutes by a plant, the tick of the seeds as they were continually projected could be distinctly heard. To place a capsule in the palm of the hand and press it suggested the bursting of pop-corn.

The shooting of the seed was done so quickly that it was some time before Mr. Walker could make out the manner in which it was accomplished.

The active agent is the outer coat of the seed. This consists of a translucent, shining, membraneous envelope stretched tightly over the seed. When it bursts, it suddenly and elastically turns inside out; after which it becomes flaccid.

This coat is thicker in a line along the ventral margin of the pendulous seed, or along the edge which is next the axis of the capsule. The rupture is naturally along the opposite edge. Doubling back against the axis of the upright capsule gives this membraneous coat or spermoderm the power to project the seed.

Placing some of the seeds under a lens and puncturing the coat with a needle, the rupture was found to occur at other parts than the margin, or at any point the coat might be pricked. In this instance the envelope, not having a "back-stop," was often thrown farther than the seed.

When in the capsule the position of the seeds is such as to throw them not only outward but slightly upward. They are cast farther than if projected horizontally. Some seeds were found as far as three feet from the capsule from which they were thrown.

Weeds as Large as Trees.—Of all the routes across the United States to the Pacific coast there is not one that has not done more or less to familiarize the traveling public with what is called sage brush. The further south the route the more abundant is this weed, which has added a phrase to our language by giving its name to the soil upon which it thrives—often when nothing else of vegetation can endure beside it. To speak of a reach of country as "sage brush land" is to present a picture to the mind of a man familiar with the far West. Through that phrase such a man sees a treeless, parched plain or bench of dull, baked-looking earth, dotted with thick-stemmed, dry, flannel-like, dust-covered shrubs of a greenish, whitish-brown appearance. These grow as garden weeds do in the East, a hand high or a yard or so above ground. The land which is distinguished by their presence, in greater or less quantities, is that part of the plains and Rocky Mountain region which receives the least rainfall. A major part of it was once known as the Great American Desert.

The sage brush is known to scientists as *Artemisia tridentata*. Most persons who are familiar with it think of it as an ordinary weed of small size, and even so high an authority as the "Encyclopedia Britannica" refers to it as growing in "treeless valleys and slopes." It will astonish most persons to know that it sometimes grows to such proportions as to provide a section of country with trees of its own wood, producing groves of thick-trunked and comparatively tall trees, instead of mere weeds. Prof. Elwood Mead, the State Engineer of Wyoming, while exploring the northern end of central parts of that State last summer, came upon a district where the sage brush thrived thus gigantically. Many of the sage trees that he saw were eighteen feet high, with trunks at least a foot in diameter. This was in the Big Horn Basin, east of the National Yellowstone Park and northeast of the Wind River Indian Reservation, where the No Wood River joins the Big Horn.

Prof. Mead returned to Cheyenne enthusiastic in his praise of the basin now little known except to the stockmen whose cows range there. It is as big as some of the older States, and will provide plenty of water for irrigation from the tributaries of the Big Horn River. Several very large irrigable tracts have been surveyed already. No railroads yet reach the district, but the Burlington & Missouri Railroad is building to Sheridan in the county of that name, and has employed its agents to "spy out the land" beyond. Prof. Mead had never seen such big sage brush as he discovered there, but since his return he realizes the truth of Solomon's assertion that there is no new thing under the sun, because he has been informed that, at some point in California, the same weed "grows to such proportions that the people cut it for cord wood."

Fixation of Free Nitrogen by Plants.—Schloesing and Laurent, pursuing their investigations on this subject, after describing the methods adopted in their experiments, proceed to detail their latest results. Dealing with seeds planted in prepared soils containing the micro-organisms usually found in good earth, they have not found any plants, outside the *Leguminosæ*, capable of fixing free nitrogen. Their most recent work has been to investigate numerous cases in which the soils employed were rich in nitrogen, but again negative results were met with in experiments upon the higher plants not included in the above mentioned order. Oats, colza, grasses, and potatoes were dealt with, and figures are quoted to show that no measurable proportion of the element in the free state was fixed. It is pointed out that in such investigations it is necessary to ascertain whether any fixation of nitrogen is attributable to the plants or to the soils, and the authors insist upon the importance of the conclusion they have drawn that soils absolutely bare of vegetation, although containing appropriate micro-organisms, do not fix any free nitrogen.

Starch in Plants.—The generally accepted explanation that, in the plant, the transformation of starch into dextrin and sugar is effected under the influence of a diastasic ferment, having been contradicted in recent years by several physiologists, A. Prunet has conducted a series of experiments with potato tubers in the hope of throwing some light upon the subject. The plan adopted was to make comparative determinations of the quantities of dextrin and of sugar on the one hand and of diastase on the other, found in the anterior and posterior halves respectively of tubers in different stages of germination. The former were considered as glucose and determined by Soxhlet's method, and the amount of diastase was indicated by the process of Wortmann. As an outcome of the research, it is shown that in potato tubers there does exist a relation between the distribution of diastase and that of the dextrins and sugars; and consequently between that of diastase and the conversion of starch. The results, therefore, tend to confirm the general opinion that the digestion of nutritive matters is effected, not by the direct action of the protoplasm, but by means of diastasic substances produced as results of its activity.

Pygmies from Africa.

Two Akka girls, who were rescued from Arab capturers by Dr. Stuhlmann and his companions, have been brought to Europe, and will remain in Germany for some months. In the summer they will be taken back to Africa, where they will be placed in some mission house, or otherwise provided for. They are supposed to be between seventeen and twenty years of age. A correspondent of the London *Daily News*, who saw them at Naples, says they are well proportioned, and as tall as a boy of eight years of age. Their behavior is "infantile, wild, and shy, but without timidity." One of them was always cross, bending her head, and glaring from beneath frowning brows, while the other often laughed joyously, was pleased with bead bracelets and other trinkets given to her, and expressed by a queer sniff of her flat nose her appreciation of some chocolate bonbons. After making "a capital dinner on rice and meat," they greatly enjoyed the sunshine in a pretty garden, where they gradually grew more confident, and finally allowed themselves to be photographed arm in arm with the little son of their hostess. "The coquettish one shook with laughter, and seemed to guess that a process was going on flattering to her vanity, while the cross one still looked gloomy and suspicious. They showed neither wonder nor admiration of the people and things around them in the artistically furnished house and tasteful garden. Their eyes, though large and lustrous, have less expression than the eyes of a monkey." These interesting representatives of one of the pygmy races of the world are to be presented to various scientific societies in Berlin.

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United States Timber Test Work.

Although all the leading railroad engineers, architects, professors of engineering, and others interested in the timber tests had flooded with hundreds of letters their Representatives and Senators and the Committee on Manufacturing, in whose hands the special appropriation for the work was pigeon-holed, neither the committee nor the House paid any attention to this expression of public interest. The Senate, however, realized that there was value in the work and sincerity in its indorsers, and increased the appropriations for the Forestry Division by $8,000, that is, 20 per cent of the amount asked and considered by those in charge as necessary to continue the work on a proper business basis.

Under the circumstances, the testing will be discontinued until after July, when the new appropriations become available, and then proceed at the slow pace which Congress has set.

Although the result of the efforts of those who took active interest in securing appropriations for the work were not crowned with that success which they deserved, this is the only proper method of influencing legislation, and those interested in the investigation should not fail to move again when the new Congress assembles.

The first compilation of test results is now in the hands of the printer, and will probably be issued within six or eight weeks, as Bulletin 8, Timber Physics, part 2. It will contain the results obtained on long-leaf pine, and will especially discuss in detail the results of tests and examinations of bled and unbled timber, results which in themselves justify the expenditure by the government of money on such work.

The Forestry Division will exhibit the methods pursued in this work at the World's Fair, which will be of interest, since nowhere in the world has such comprehensive and systematic investigation of timbers been ever devised. The working plans for a similar undertaking by the Prussian government have only just been perfected.

Another exhibit of interest to railroad engineers and those interested in reducing forest waste will be a collection of the most approved types of metal railroad ties.

ANOTHER EARLY FRENCH PATENT FOR A BARBED WIRE FENCE.

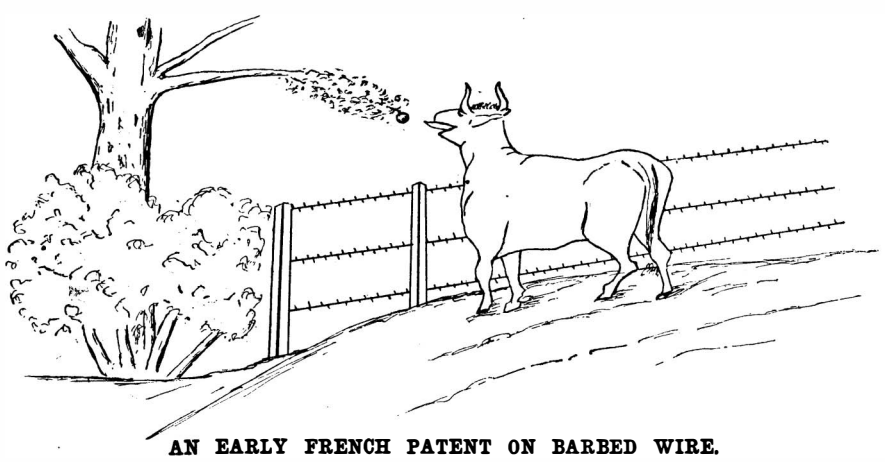
BY A. M. TANNER.

The writer has already called attention in the SCIENTIFIC AMERICAN to French patents of Grassin-Baledans, 1861, and Jannin, 1865, for barbed wire fences, which are both anterior to the earliest date of invention set up by the first American patentee of a barbed wire fence, who, as is well known, provided the wires of a wire fence with a series of spur wheels.

Almost about the same time a Breton brick manufacturer, Gilbert Gavillard, received a French patent, dated August 27, 1867, No. 77,570, for a barbed wire fence, which may be described as follows, by following as nearly as possible the French description:

This fence is composed of three galvanized wires and of spines, also galvanized, placed between and clamped by two strands, while the heads are covered by the third strand. These strands of galvanized wire are twisted together, so as to present iron thorns on all their faces. In order to form a fence, it suffices to plant posts in the ground and attach thereto, by means of iron wire hooks, three of these artificial thorny branches, which are placed at a sufficient distance apart to prevent animals from going over this thorny obstacle.

A drawing annexed to the patent is herewith reproduced.



AN EARLY FRENCH PATENT ON BARBED WIRE.

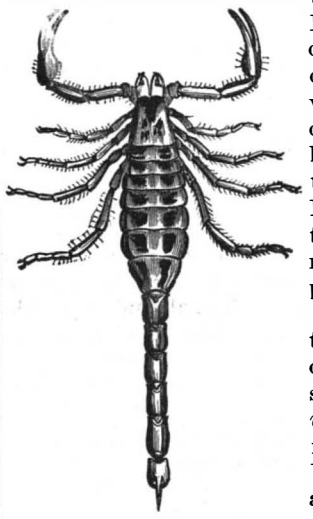
It will be seen that it presents, in a very striking way, how an ox is prevented from reaching an apple on the other side of the barbed fence. Although the drawing does not show the form of the barbs, it is evident that they are ⊥-shaped, and that the third wire or strand prevents the barbs from dropping out by locking them in place between the two other strands. The Gavillard patent may be considered as resembling the Michael Kelly patent, of February 11, 1868, No. 74,379.

Utilization of Coal Dust.

The London *Times* gives an account of a process by which anthracite coal bricks are now being manufactured by the Coal Brick Syndicate, of London. The bricks are made of grains of anthracite dust, which are forced to cohere by means of a special cementing compound and by great pressure. The coal dust is mixed with the binding material in the proportion of 96 per cent of the former to 4 per cent of the latter. The compound is fed into a mixer, where it meets a jet of steam, a stiff paste being formed, which is delivered successively into a series of moulds under a pressure of 25 cwt. As the mould plate revolves, the charge in each mould is brought between two rams, which exert a pressure of two tons per square inch on each side of the charge, forming a very dense and homogeneous coal brick. The brick, still in the mould, passes on to the delivery ram, by which it is pushed out on to a table, and is removed for the market. These coal bricks are said to make an excellent fuel and to possess a very high efficiency for steam-raising purposes. The *Times* thinks that with such a fuel at the disposal of the public there is room to hope for a reduction in the pollution of the atmosphere of towns, as well as a reduction in the coal bills of steamship companies and of steam users generally.

THE DEADLY SCORPION.

The scorpions have become so numerous in the city of Durango, Mexico, that the municipal authorities have offered a valuable prize, to be given the person capturing the largest number this month. Two thousand of the deadly pests were killed at the hospital there recently in one day. For these scorpions the city pays 60 cents a hundred, and three times a week those collected are counted and killed at the hospital, and 80,000 were thus destroyed last year. Persons who get permits to hunt the pests have the right to enter and search private houses for them.



We give a cut of the little *Buthus carolinianus*, or, as it is now called by systematists, *Centrurus vittatus*. This is the commonest scorpion of the United States, and is found as far north as Tennessee and North Carolina. Of the larger species of the Southwest we have no figure. This, however, will do fairly well for a representative of the family.

The Submarine Atmosphere.

BY A. E. RICHARDSON, B.A., F.C.S., A.M.I.E.E.

It is a well known fact that the amount of gas capable of being held in solution by a given liquid is directly proportional to the pressure exerted, unless chemical combination takes place between the gas and the solvent. But the pressure of any point within a fluid, which is incapable of being compressed, is proportional to the depth of that point below the surface of the fluid. Consequently it is obvious that the water deep down in the ocean must be capable of dissolving greater quantities of air than water at the surface.

To illustrate this point, let us take an extreme case and roughly calculate the volume of air which could be absorbed by unit volume of water deep down in the sea. The depth of the Pacific Ocean is known to be as much as 40,000 feet (or 7½ miles) in at least one place.

First, we will calculate the pressure exerted upon a cubic foot of water at that depth. Assuming that the specific gravity of sea water is roughly 1·026, a cubic foot of sea water will weigh 1,026 oz. (a cubic foot of distilled water is generally taken as weighing 1,000 oz.) Then the pressure exerted per square foot at a depth of 40,000 feet will be

$$40{,}000 \times 1{,}026 \text{ oz.} = 40{,}000 \times \frac{1{\cdot}026}{16} \text{ lb.}$$

Hence the pressure per square inch will amount to

$$\frac{40{,}000}{144} \times \frac{1026}{16} = 17{,}812\tfrac{1}{2} \text{ lb.}$$

The pressure due to one atmosphere may be roughly taken as 15 lb. per square inch. Thus the pressure at a depth of 40,000 feet is equivalent to that of 1,187 atmospheres. This, with the pressure due to the air above, amounts to 1,188 atmospheres.

It must be borne in mind that this is only an approximate calculation. For instance, the density of sea water is taken at a rather low figure, and no allowance is made for the compressibility of sea water under great pressures.

Accepting, however, 1,188 atmospheres as the approximate pressure at the stated depth, let us calculate the volume of air which a unit volume of the water would be capable of dissolving under this pressure.

I have no data at hand for the absorption coefficients of sea water for oxygen and nitrogen or for air; so I will take the coefficients for pure water. Here again an error will arise, for sea water cannot absorb so much air as ordinary water; for it has been found that in solutions of different substances the solubility of gases is in most cases diminished.

One volume of water at normal temperature and pressure absorbs about 0·0245 volume of air. With the temperature remaining constant the volume of gas absorbed remains the same under all pressures. But this volume of air, under a pressure of 1,188 atmospheres, would occupy a volume of 0·0245 × 1,188 under normal pressure. This quantity amounts to 29·106 volumes. Hence a cubic foot of water at a depth of 40,000 feet is capable of absorbing 29 cubic feet of air measured at normal pressure.

Since a c. c. of air weighs 0·00129 grm., 29 c. c. will weigh 0·037 grm. That is to say, the water in question would be capable of dissolving about 1-27 of its own weight of air. Nor does there seem any reason to suppose that this amount of air is not absorbed, for the atmospheric gases must permeate the whole of the ocean's depth in order that deep sea fishes may obtain the oxygen necessary for the preservation of their existence. At a depth of 1,380 feet water absorbs its own volume of air (measured at atmospheric pressure). Thus in all water below this depth there is dissolved more than its own volume of air. We have then a second but submerged atmosphere.

In this most marvelous submarine atmosphere are vast quantities of air stored away—how vast it is difficult to estimate. Remembering that three-fourths of the face of the earth is covered by water, one is apt to conclude that there is almost as much air hidden away in the ocean's depth as is found above its surface. What effect such great pressures have upon the solvent powers of the water for solid constituents it is doubtful to say. Probably the solvent powers are much modified by the presence of such quantities of dissolved gases. It is possible that such considerations as the foregoing have already appeared in print. As, however, I have never read or heard of such suggestions, I venture to bring the question before your readers.—*Chem. News.*

Aluminum Light.

A remarkable kind of light has been successfully exhibited by Dr. Philip Lenard, of Bonn, and has formed the subject of a paper read before the Royal Prussian Academy of Sciences at Berlin. Hertz has shown that the rays which proceed from the cathode of a Geissler tube, and are capable of exciting phosphorescence, will permeate thin metal. If then it were practicable to find a sheet of metal foil thick enough to be air-tight and opaque, yet thin enough to be permeable by this discharge, it would be possible to allow these rays a passage into the open air by closing an opening in a discharge tube with such a piece of foil. This idea has been realized by Dr. Lenard by means of an ingeniously arranged apparatus and a hammered aluminum plate 0·003 millimeter thick. This plate forms in the apparatus in question a shutter which Dr. Lenard calls the "window," because, while quite impermeable to air and light, it allows the rays from a cathode at a distance of 12 centimeters to penetrate it freely. These rays render the air faintly luminous. A halo of bluish light surrounds the "window," and is moderately bright only on its surface. At the same time a strong odor of ozone is recognizable. Substances capable of phosphorescence, if held near the "window," shine with their peculiar light on the side nearest to it. All the phenomena of phosphorescence cease if a magnet is so applied to the discharge tube as to repel the cathode rays from the inner side of the "window." The atmosphere is a dull medium for the cathode rays to penetrate, coal gas is more permeable, and so is hydrogen, while oxygen and carbonic acid are less permeable than air.

Cost of Columbus' Expedition.

The cost of discovering America by Columbus, says Prof. Ruge, in the "Globus," was 1,140,000 maravedis, or about $7,296 of our money. The money of Queen Isabella, of course, had a higher purchasing power than the dollar of to-day. Of the sum named, Columbus received an annual salary of $320, and the two captains each $192 per year. Each sailor, in addition to his subsistence, received $2.45 per month, or one ducat.

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RECENTLY PATENTED INVENTIONS.

Engineering.

HYDRAULIC EXCAVATOR. — Adoniram Fairchild, New York City (deceased, Benjamin D. Fairchild administrator). This is an improvement upon a formerly patented invention of the same inventor of a device for the removal of sand, mud, and gravel from a water bed, and provides for a construction to permit the outer shell of the excavator to be extended down to form an annular chamber between the shell and lift pipe, water being forced from the exterior to enter this space, carrying into the lower end of the lift pipe excavated material loosened by water jets within the annular chamber. The entire device is swung by chains or ropes from a laterally movable support above the water surface.

BOILER.—Frank Saxon, Worthington, Minn. Return flue boilers for road or traction engines are provided by this invention with a front extension to save the flame sheet and that portion of the flue sheet above the water line. The extension is hinged to the main portion of the boiler, so that its interior may be easily examined, the hinges forming the supply and discharge pipes, and the extension supplies hot water to the interior of the main boiler. By the improvement a greater amount of heating surface is obtained, with a consequent increased economy of fuel.

Railway Appliances.

CAR BRAKE.—Howard B. Hanmore, St. Paul, and Thomas N. McLean, Fergus Falls, Minn. Brake levers on the brake beams are, according to this invention, connected together, and springs under the car body are connected by a link with one brake lever, while a sink connects the other brake lever with a fixed support, and operating levers are connected with the springs. The construction is such that the operator cannot increase the power more than the coefficient between the load and the rail, thus preventing the wheels from sliding, lessening the friction, and the liability to the destruction of the wheels.

CAR TRUCK.—Gustavus L. Stuebner, Long Island City, N. Y. This is an improvement upon car trucks having pilot wheels to keep the trucks on the track in passing swiftly around short curves. Guide wheels of less diameter than the supporting wheels are carried by the advance axle and adapted to engage the inner surfaces of the rails, while the trucks are pivotally connected with the car by attaching the body of the car to the bolster of a truck, enabling the truck to accommodate itself to very sharp and quick turns. The guide wheels are virtually small pilot wheels held on a shaft journaled in arms projected from the bolster.

CABLE GRIP.—Henry A. Shipp, Atwater, Cal. By this device it is designed that the operator shall be able to graduate the grip on the cable according to the load to be pulled. A slide is movably held in a grip frame on which is pivoted a lever actuated from the slide, jaws on the lever on opposite sides of its fulcrum engaging the cable. By means of mechanism convenient to the operator, the slide may be moved so that the jaws will take a more or less heavy grip upon the cable.

Mechanical.

POLYHEDRAL LATHE. — Manuel Rul, City of Mexico, Mexico. This lathe has a cutter shaft and swinging supporting arms, against one of which bears a tension device, in combination with cutter clamping and guiding ams movable along the tool shaft, and other novel features, whereby work may be quickly performed and prisms of any character be turned, and whereby also a number of articles may be placed in the lathe and presented consecutively to the turning or cutting tools. At one revolution of the chucks it is possible to turn one face of all the articles carried by the chucks, the articles being then reversed to offer another face, and the operation being repeated until all the predetermined faces have been made.

MOULDING PROPELLERS.—Louis His, New York City. To obviate the necessity of using patterns in casting propeller blades for vessels is the design of this invention, which provides a flask with side pieces of dissimilar height having rows of perforations, a perforated grooved end piece connecting their outer portions, while an adjustable bottom has fastening bolts to enter the perforations in the sides and end of the flask. By this means propellers may be moulded with great accuracy and facility, two flasks being employed for the opposite sides of the propeller blades, the spindle and flasks being arranged upon a perfectly smooth and substantial bed, and the pouring being done in the usual way.

Agricultural.

PLOW.—Ramon G. Rivero, Monterey, Mexico. This is a double mouldboard plow, designed to cut the earth uniformly, run comparatively easy, and completely turn the furrow in all cases. It has a flat, straight-edged point, preferably made separate from an angular share having horizontal lateral wings, and the rear edge of the share is riveted to the mouldboards. The plow is very light, yet strong.

LAND ROLLER AND HARROW.—Carl Storla, Belford, South Dakota. The forward portion of this implement consists of a harrow for breaking or pulverizing lumps of earth, and behind the harrow are front and rear rollers arranged to cover every portion of the ground and prevent the formation of ribs. Each of the rollers is provided with an efficient scraper and a lubricating device, and the machine has markers to indicate to the driver the line along which the center of the implement must move to thoroughly cover the ground.

Miscellaneous.

PLACER MINING APPARATUS.—Marshal D. Platner, Elliston, Montana. This apparatus has an upper sluiceway with a perforated floor, below which is a lower sluiceway, into which delivers a mercury tank, there being riffle plates in the lower sluiceway below the tank, and a concentrating device receiving the discharge, while a pump forces the amalgam from the concentrating device back to the mercury tank. The invention also covers other novel features, the apparatus being designed to rapidly make a clean separation of sand and gold, and also to facilitate the separation of precious stones, where they occur in the diggings.

WATER WHEEL AND ELEVATOR. — John B. Lockwood, Helmville, Montana. This is a device supported to have its paddles dip in the surface of and be revolved by a stream, while it at the same time elevates and discharges water for irrigating or other purposes. A cylinder secured to a shaft has end flanges, beyond which the paddles project, while buckets are formed between the paddles, and guide strips aligning with inner edges of the flanges guide the water raised by the buckets to a sluice for delivery at any desired point.

BIOPTOSCOPE. — Charles H. Meddins, Omaha, Neb. This is a simple apparatus to show moving objects in a succession of fixed positions. It consists of a frame with apertures on opposite sides of its center, a handle and mouthpiece, and to the frame is pivoted a disk with other corresponding apertures, and having inclined vanes or wings. It is designed mainly as a toy, but may be used to observe the movements of animals and birds, and also for inspecting rapidly moving parts of machinery.

STOP WATCH.—Adolphe G. Guerin, Savannah, Ga. The second hand of this watch may be stopped through the stem-winding mechanism without stopping the minute and hour hand or interfering with the movement of the watch, facilitating the readjustment of the second hand in relation to the minute and hour hand, and also adapting the watch for use for racing purposes. The improvement consists in a special mechanism connecting the second hand to the stem-winding and setting devices.

WIRE STRETCHER AND REEL.—Edgar S. Hoge, Morris, Ill. This is a machine to be drawn along by a horse and adapted to reel up or pay out wire, stretching the wire as it leaves the reel. The reel is one side of a frame which may be rotated in either direction and be locked, as required, the reel being supported on a crank-handled shaft, and a ratchet being connected with the shaft. A novel wire-guiding mechanism and a simple brake device form features of the invention.

TREATING SEWAGE.—James J. Powers, Brooklyn, N. Y. A process of chemically treating and purifying sewage before its discharge has been provided by this inventor, the sewage being moved forward through suitable conduits, at the head of which are introduced disinfectants and substances forming with the sewage compounds insoluble in water, the floating and sedimentary matter being removed. and the entire body of sewage simultaneously treated with a disinfectant or germ-destroying gas. The water separated out is finally treated with liquid disinfectants.

LAND ROLLER.—Eli W. Farr, Cedar Springs, Mich. This machine has a front and rear section, and comprises a series of rolls independently mounted upon a frame, the rolls being capable of vertical movement at their ends, or being adapted to be so fastened to the frame that they will be held straight. The machine will work upon even as upon uneven ground, and when not in use the sections may be uncoupled and the machine stored in small space.

SLEIGH.—Willie N. Snow, Snowville, N. H. This invention provides an improvement in the running gear of side bar spring sleighs, by means of which such gear may be cheaply made and very strong. The invention covers certain features of construction and combinations of parts.

THILL COUPLING.—William H. Tydeman, Walsenburg, Col. When the shaft iron of this device is in draft position it cannot be disconnected from the coupling, but such separation is readily effected when the shaft iron is carried up to an angle of forty-five degrees. The coupling is practically automatic, as no wrenches or other tools are required in its manipulation, and an elastic block held against the clip section renders it anti-rattling.

FLOWER POT AND STAND.—Alfred A. Holt, Brooklyn, and Jacob P. Kooy, New York, N. Y. A very ornamental stand is made to serve as a casing for a flower pot, while it has a lower chamber forming a readily removable water receptacle. The pot fits into the stand so that its bottom rests in the water in the receptacle, and should water overflow from the top of the pot, it will be received and held in the receptacle or the casing.

BOOK BINDING AND BOOK.—Johann G. Bast, Brooklyn, N. Y. This binding comprises a series of sections with a rod on the back of each, binding strips extending across the rods on the outside and a binding cord uniting the leaves of each section, fastening the rod to its section and the binding strip to the rods, while also flexibly connecting the several sections of the book with each other. This binding combines strength with durability, and the leaves lie perfectly flat when the book is opened.

MUSIC BOOK OR FOLIO.—William H. Ayres, Sackett's Harbor, N. Y. This invention relates to books or folios adapted to be supported on portable music racks, affording a cheap and strong book, with means for fastening the leaves so that none will be hid den. Any number of sheets or leaves may be quickly and strongly fastened in place, rings serving as a means of attachment or hinges for the sheets of music, held between covers in the usual way.

EGG POACHER.—Clara T. Gott, Seattle, Washington. Upon a perforated plate having a central vertical handle is fixed a series of disconnected rings, hinged to the plate, so that any of the rings may be swung up to remove an egg without releasing the contents of the other rings. To cook the eggs, each one is dropped into a separate ring and the poacher is placed in a pot or basin containing boiling water.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(4967) E. B. asks: 1. Are cast iron pole pieces any better than wrought iron for dynamos? A. Cast iron pole pieces are preferred to soft wrought iron, on account of their ability to retain sufficient magnetism to start the machine. 2. About how long would a storage battery (such as is described in a late number of the SCIENTIFIC AMERICAN) hold its charge if the plates were 2 inches by 5 inches? A. The storage battery might hold the most of its charge for three or four weeks, but it will begin to run down immediately after charging.

(4968) J. C. B. writes: Would it be practical and would it be a successful drive to run a paper friction on a crown face wheel? I have a fly wheel on an engine shaft ten feet diameter, twenty-four inch face. This wheel has three-sixteenths of an inch crown. Now I want to put an eighteen inch paper friction on this wheel to run a dynamo. The question is, Will it be a successful drive or will there be too great a loss of power, owing to the fact that the friction wheel is running on a crown face? In other words, What would be the true action of the friction on the crown face wheel? Can you give me any rule for calculating the power transmitted by paper friction? A. The running of a friction wheel on a fly wheel of the width and diameter named will make but little friction, from the small curvature of three-sixteenths of an inch in 2 feet in width. If the driven wheel is covered with thick sole leather, so that it will be slightly elastic on the surface, it will take better to the crown and give a better working power. The transmitting power of good friction gear is fully equal to belting with the same pressure on the pulleys as the tension on belts. See Cooper's work on "The Use of Belting and Friction Gear," $3.50 mailed.

(4969) W. F. B. asks: What proportions of gasoline vapor and air are necessary to run an engine? A. 25 to 35 volumes. 2. How many pounds per square inch should it be compressed before it will ignite? A. No compression is needed.

(4970) W. C. V. N. writes: Suppose that a drum on a hoisting engine is held by a friction clutch so that it just raises a weight of one ton, one hundred feet a minute. Theoretically would that clutch slip if the engine were driven so that the weight would rise two hundred feet per minute, all other things being the same, only the increase of speed? A. Increased speed in hoisting means increased power. The friction clutch set for a given hoisting speed will slip if the speed of the engine is largely increased or doubled.

(4971) R. M. writes: We desire to use a wire belt to run over a smooth surface and would like to get it down as low as No. 12 wire. We shall run six or eight belts in number, side by side, but all of them entirely separate and distinct, but over the same pulleys. Could you give us an idea of what is the best wire to use and whether to use a very fine quality of steel or soft wire? The size of the pulleys will be 12 inches for the smaller one and the other will be larger. A. The ordinary unannealed steel wire is the best for your purpose. Pulleys should be grooved to fit the wires. You would get better service if the small pulley were larger, say 16 inches, as the constant running of a No. 12 wire over a 12 inch pulley tends to crystallize and weaken the steel wire.

(4972) F. J. H. asks: How can I make a cheap sand pump for pumping quicksand out of well 32 feet deep? A. You can make a cheap sand pump with a piece of stove pipe or a strong tin can. Put a bottom in one end of a length of stove pipe, with a lip like an auger bit, and fasten the other end to a pole, so that by turning it around in the quicksand a charge can be drawn into the pipe and lifted out. The same can be done with a tin can, by cutting a slot in the bottom from the center to the edge and pressing down one edge into a lip. Fasten to a pole, as with the piece of stove pipe.

(4973) C. & T. write: Will you please tell us what is meant by gold filling; for instance, gold-filled watch cases? What is the process? A. Filled gold work is made by backing good gold, 16 to 18 carat fine, with silver or other solder as a filling for stiffening or to make up weight. For watch cases, where the inside also shows gold, the base metal is plated on both sides, while in a thick slab, with good gold plate, by soldering with silver or other hard solder. The whole is then rolled down to the proper thickness for making the cases. Rims, rings, and knobs are made by drawing gold tubing over brass or silver wire and soldering with hard solder, when the rims can be drawn down to the proper shape. Knobs are struck up by drop presses in thin solid gold plate and filled with silver solder.

(4974) J. L. C. writes: I can find no way in which to make solder stick to my soldering iron, as this is necessary to make neat work. I write to see whether you can furnish me with an effectual recipe. A. It is necessary to tin the soldering copper with pure tin, not solder. Rub the hot copper on a piece of sandstone or a brick to brighten the surface, and at the same time sprinkle some powdered sal ammoniac on the brick and apply a stick of tin to the copper, rubbing the point on the stone or brick in contact with the sal ammoniac and tin.

(4975) H. D. M.—The reason why you did not succeed in your experiments was clearly because you did not follow the instructions. We do not think you ought to expect to have a mixture of sulphur and plumbago act the same toward gases as the carbon would; neither can you expect the artificial carbon to take the place of charcoal. We have no doubt if you closely imitate Jablochkoff's experiments you will succeed as well as he did.

(4976) A. M. M. asks how an electric motor exerts force—by attraction of armature or by repulsion of armature, or by both? Also, why is it that electric motors cannot be made of more than say 80 horse power? What is it that imposes so low a limit? A. The force of an electric motor is mainly that of attraction, although repulsion plays a small part in its operation. We know of no reason why electric motors cannot be made of greater power than 80 horse power.

(4977) A. M. P. asks: Can aluminum be put on plates like those used for tin, or dipped like tin plates? With the same thickness of coat, will they cost any more? (If manufactured, name firm.) Can the material be used for keeping fruit in? Can tin and aluminum be mixed and used to plate iron? A. Aluminum melts at a full red heat, and is not a suitable metal to coat other metals with as tin is used. The electric plating is not very much used. Tinning iron plate with an alloy of tin, with 3 per cent of aluminum, makes the tinned surface a little harder and less acted upon by acids. This alloy will no doubt be the best surface for fruit cans.

(4978) C. L. R. says: Our 150 horse power Westinghouse engine gives a great deal of annoyance at night by the heavy exhaust. The company want to put in a sewer for the exhaust, but I am in doubt as to the plan. Hence write you. The sewer will be about 100 feet long, opening into a creek. If you can suggest a plan to help us, I shall be obliged to you. A. You can muffle the exhaust by turning it into a tank. A cylinder about 3 feet diameter, 4 to 5 feet long, set upon the roof, with a larger pipe to the open air. The cylinder may be made of thin plate iron, 1/8 inch thick. A drip should be inserted at the bottom. A common practice in New York is to fit a sleeve on the top of the exhaust pipe, to which attach a double cone drum of heavy galvanized sheet iron, which, for your 150 horse power engine, should be of about the capacity of the tank above mentioned. The opening at the top should be double the area of the exhaust. A baffle plate is put in the center and braced so as to break the direct flow of the exhaust direct through the drum.

(4979) W. P. M. writes: 1. In the winter of 1891-92 I built a small steam launch, length 25 feet, beam 5 feet. She will run, in slack water, 8 miles per hour, and is fitted with 1 horse power engine and boiler, which drives a three blade 16 inch wheel 500 revolutions per minute. I wish to know if I could not get more speed with an 18 inch wheel, or would it be taxing the engine too much? A. Whatever extra speed you may get with an 18 inch wheel must be derived from additional power in the engine, and to get more power from the engine means higher steam pressure. If your boiler is strong enough for the pressure required to give the engine 500 revolutions per minute with the larger wheel you may increase your speed. 2. In small launches, say under 40 feet, does increase of length, without a corresponding increase of beam, detract from safety or seaworthiness; or, in other words, is a launch, fitted with the same machin-

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ery, 5 feet beam, 25 feet long, more safe than one 5 feet beam and 30 feet long? A. An increase in length for a given beam over the usual practice, or to the proportions named, may be made with safety; but precautions should be taken against shipping water in the choppy seas of the lakes. 3. What is the simplest and best way to make a sea anchor or drag, and what size should it be for launch 5 × 25? Should not care if boat drifted some. Simply wish to be in a position to be able to hold her head to sea in case of accident to machinery. A. For a sea anchor for your boat use a pine board, 1 inch thick, 18 inches wide, 4 feet long, with a couple of battens to stiffen it. Load one edge with lead or iron, so that it will float edgewise with the light edge 1 inch out of the water. Bore two holes near the bottom and ends and one hole at the top and middle. Fasten a three-part sling of ¼ inch rope through the holes, so that when the anchor is held at the intersection of the three ropes it will hang level. To the apex of the sling fasten the drag rope.

(4980) **T. C. S. writes:** We have been considering the construction of a dam across a tolerably small stream (fed by three springs), for the purpose of making a fish pond. What is the most approved dam, expense, durability, and convenience being considered? Will add that the incline on each side of the stream is, while not abrupt, rather steep, and that the area drained by it is not more than ten or twelve acres. A. The building of a dam, however small, should have more than a casual consideration, in view of the total flow that might come from a storm. The construction should also take its strength from the height and length, as also from the nature of the ground as to its stability to hold a dam, which also may indicate the depth necessary for a foundation. A curved stone wall, backed with clay and earth, with a central spill and riprap beneath is the best. Leffell's work on mill dams gives illustrations and description of many kinds of dams. $2.50 mailed.

(4981) **E. L. O. asks:** What is the scientific reason for the use of storm sash? Because they close the joints around the sash, or because heat condenses more rapidly on the glass than on other portions of the building? A. The reason is not a strictly scientific one—it is more a matter of comfort and convenience, the main object being to keep out the cold air that presses through the crevices around and between the sash in windy weather. It also prevents excessive circulation of the air within the rooms by cooling against a single glass and dropping to the floor—a dangerous source of cold to persons standing or sitting near a single window in cold weather. The double glass also keeps moisture and frost from windows, from the fact that the moist air of the rooms is prevented from coming in contact with the cold outside glass, the air between the glasses holding too little moisture to produce frost or condensation on the outer glass.

SELKIRK, PA., April 17, 1893.

To the Editor of the Scientific American:

DEAR SIR: I notice in your "Notes and Queries," No. 4889, F. H. asks what to do for the crank on his 14 × 16 center crank engine. I would say we are running the same kind of engine in our sawmill and had the same trouble he complains of. We tried all kinds of lubricants, but could not overcome the difficulty. Finally I took the brasses and had them counterbored and filled with No. 1 babbitt and bored out to fit the crank pin. Now we have no trouble and can run the engine without any trouble whatever with any kind of oil. Everybody at the shops said the babbitt would pound out, but it did not. Now all the engines in the mills in this section are fixed in the same way, and nobody experiences any difficulty. Hoping this may help some of your readers,

I remain yours truly,

WILLIS KERR.

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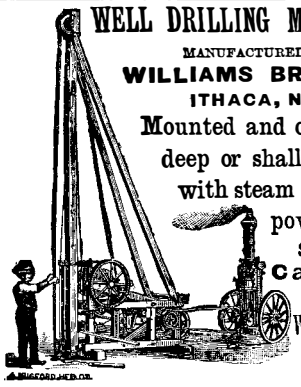

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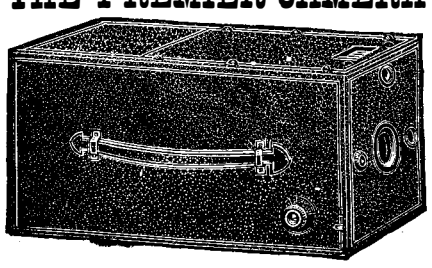

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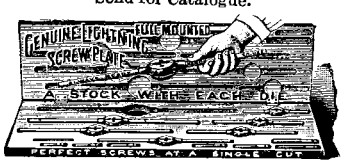

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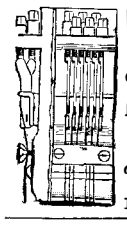

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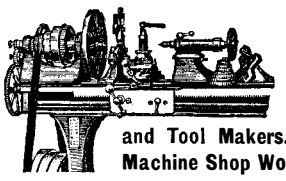

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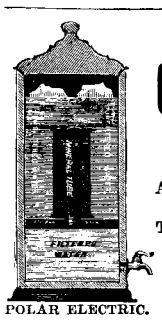

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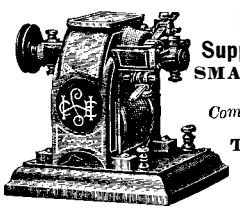

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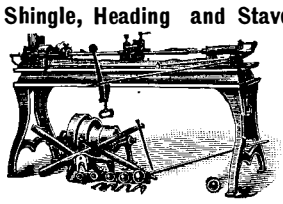

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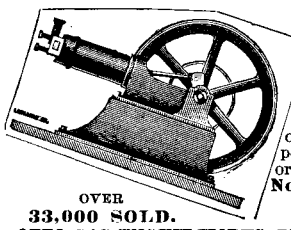

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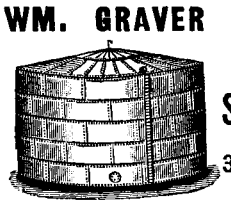

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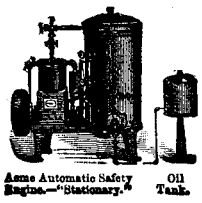

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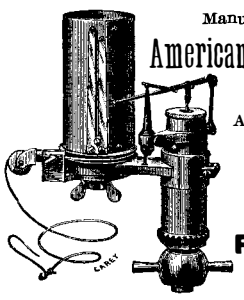

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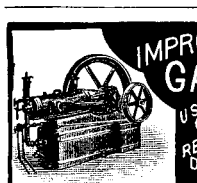

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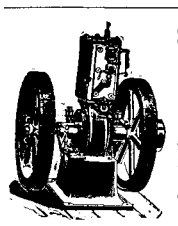

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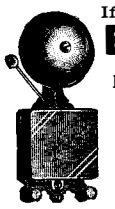

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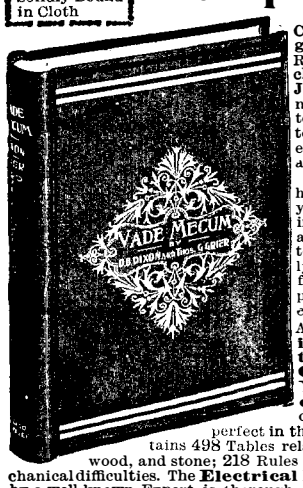

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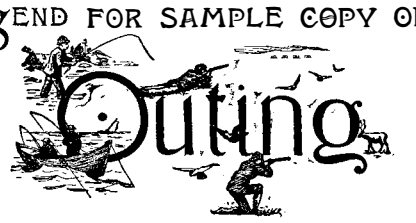

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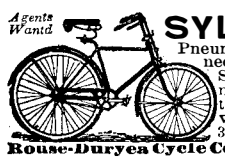

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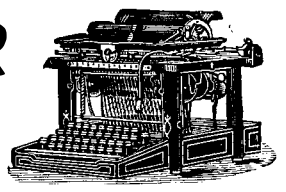

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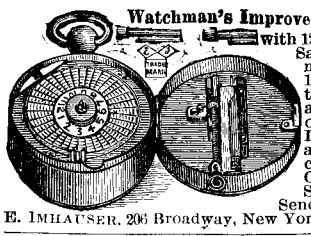

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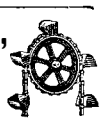

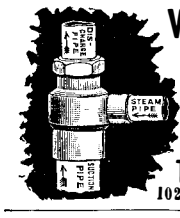

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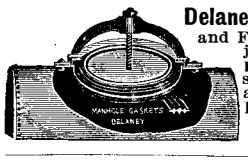

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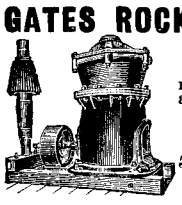

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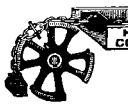

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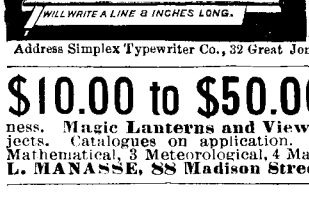

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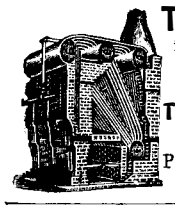

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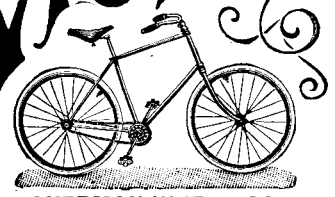

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WASHINGTON, SAN FRANCISCO.
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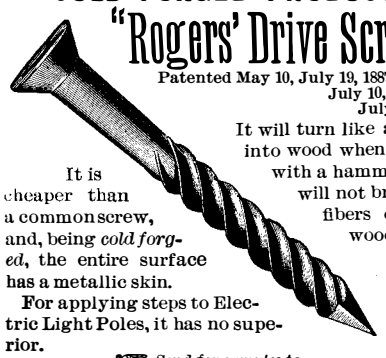
COLD FORCED PRODUCT.
"Rogers' Drive Screw."
Patented May 10, July 19, 1887; July 10, 1888; July 19, 1892.



It will turn like a screw into wood when driven with a hammer, and will not break the fibers of the wood.

It is cheaper than a common screw, and, being *cold forged*, the entire surface has a metallic skin.

For applying steps to Electric Light Poles, it has no superior.

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Fully warranted. Sent on trial under favorable conditions. You make no mistake buying one of these Rifles. Manufactured by
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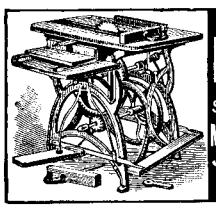

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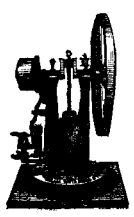

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ADAPTED TO ALL CLIMATES ESPECIALLY MARINE EXPOSURES.
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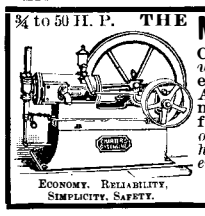

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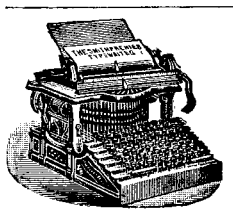

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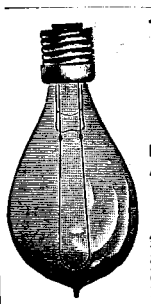

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This Company owns the Letters Patent No. 186,787, granted to Alexander Graham Bell, January 30, 1877, the scope of which has been defined by the Supreme Court of the United States in the following terms:

"The patent itself is for the mechanical structure of an electric telephone to be used to produce the electrical action on which the first patent rests. The third claim is for the use in such instruments of a diaphragm, made of a plate of iron or steel, or other material capable of inductive action; the fifth, of a permanent magnet constructed as described, with a coil upon the end or ends nearest the plate; the sixth, of a sounding box as described; the seventh, of a speaking or hearing tube as described for conveying the sounds; and the eighth, of a permanent magnet and plate combined. The claim is not for these several things in and of themselves, but for an electric telephone in the construction of which these things or any of them are used."

This Company also owns Letters Patent No. 463,569, granted to Emile Berliner, November 17, 1891, for a Combined Telegraph and Telephone; and controls Letters Patent No. 474,231, granted to Thomas A. Edison, May 3, 1892, for a Speaking Telegraph, which cover fundamental inventions and embrace all forms of microphone transmitters and of carbon telephones.

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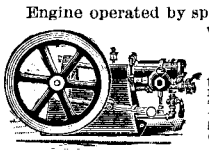

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